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NATIONAL DAM INSPECTION PROGRAM. SHOHOLA MARSH DAM (NDI-PA 0041--ETC(U)
FEB 79 DACW31-79-C-0010

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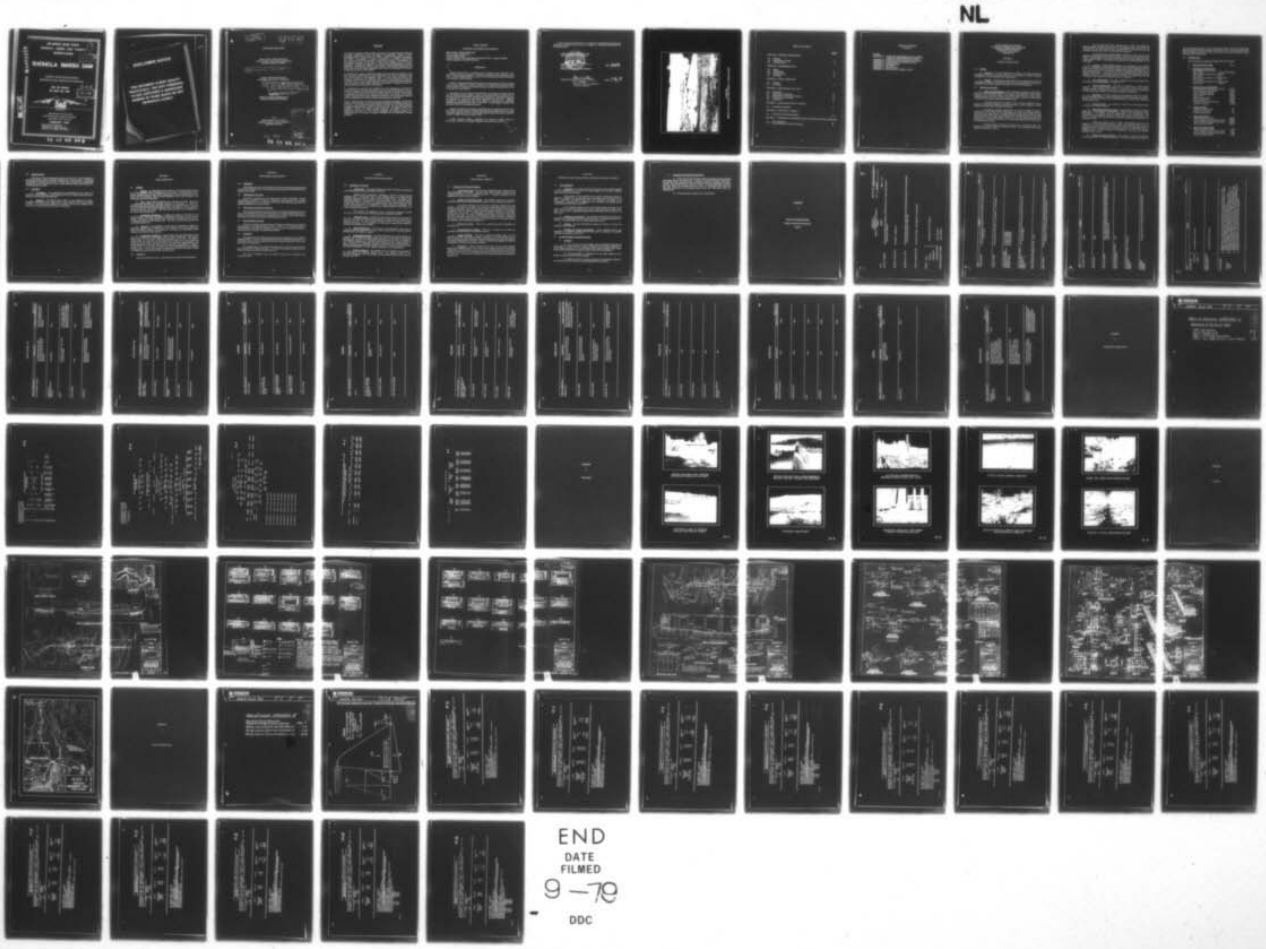

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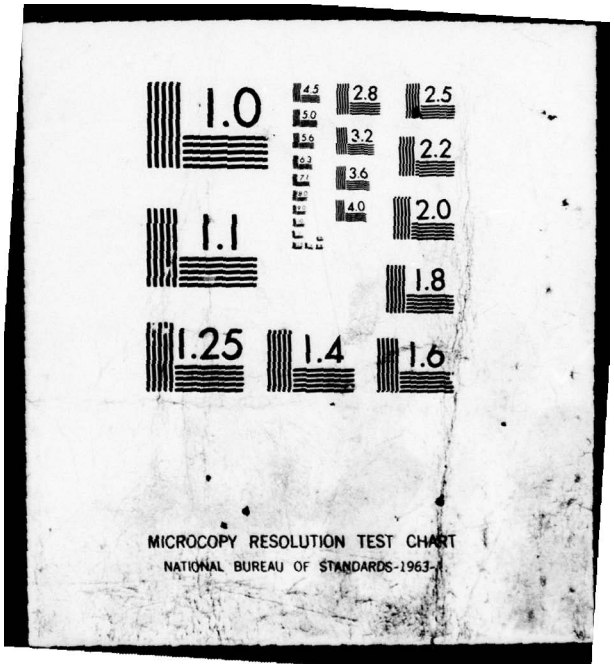
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DELAWARE RIVER BASIN

SHOHOLA CREEK, PIKE COUNTY

PENNSYLVANIA

SHOHOLA MARSH DAM

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NDI-PA 00412

PA DER 52-158

PREPARED FOR

DEPARTMENT OF THE ARMY

BALTIMORE DISTRICT, CORPS OF ENGINEERS

BALTIMORE, MARYLAND 21203

FEBRUARY 1979

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(12) 89p

(11) Feb 79

DELAWARE RIVER BASIN

Name of Dam: Shohola Marsh Dam
County & State: Pike County, Pennsylvania
Inventory Number: PA 00412

(15) DACW31-79-C-ØØ10

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

(6) National Dam Inspection Program. Shohola Marsh Dam (NDI-PA ØØ412, PA DER 52-158), Delaware River Basin, Shohola Creek, Pike County, Pennsylvania. Phase I Inspection Report.

Prepared by:

O'BRIEN & GERE ENGINEERS, INC.
JUSTIN & COURTNEY DIVISION

For:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, MD 21203

410 760

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT

NATIONAL DAM INSPECTION PROGRAM

Name of Dam: Shohola Marsh Dam
State Located: Pennsylvania
County Located: Pike
Stream: Shohola Creek Coordinates: Latitudes 41°23.4' Longitude 74°58.2'
Date of Inspection: November 22, 1978

ABSTRACT

ASSESSMENT

Shohola Marsh Dam is a concrete gravity structure which impounds a 1137 acre lake at normal pool elevation. Construction of the dam was completed in July, 1968. Shohola Marsh Reservoir is owned by the Pennsylvania Game Commission and is used as a wildlife habitat.

Based on visual observations made during the field inspection, the dam appears to be in good condition. The dam is classified as a "high" hazard structure which indicates there is potential for extensive property damage and possible loss of life in the event of a dam failure.

Examination of the results of the hydrologic and hydraulic analyses indicates that the existing spillway system is able to pass approximately 63 percent of the Probable Maximum Flood (PMF) without being overtopped. It appears the spillways are designed for heads less than those associated with the PMF. Negative pressures on the downstream face of the spillway would develop for discharges exceeding approximately 30 percent of the PMF. For discharges in excess of 50 percent of the PMF, cavitation may occur.

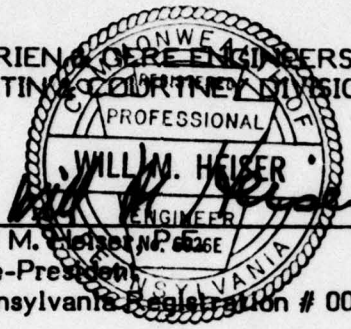
Stability analyses of the spillway system and the non-overflow portion of the dam reveal that the resultant of forces falls outside the middle third of the base for loadings associated with 1.) Normal and 5 kips per square foot (ksf) ice load, 2.) ½ PMF, 3.) Water to the top of dam, 4.) PMF.

Further detailed stability, hydrologic and hydraulic studies should be performed to determine if remedial measures are necessary at this time.

ABSTRACT

A flood warning system should be developed and implemented because of the downstream population areas which are subject to flooding during periods of high precipitation.

O'BRIEN & GERE ENGINEERS, INC.
JUSTIN & COURTNEY DIVISION



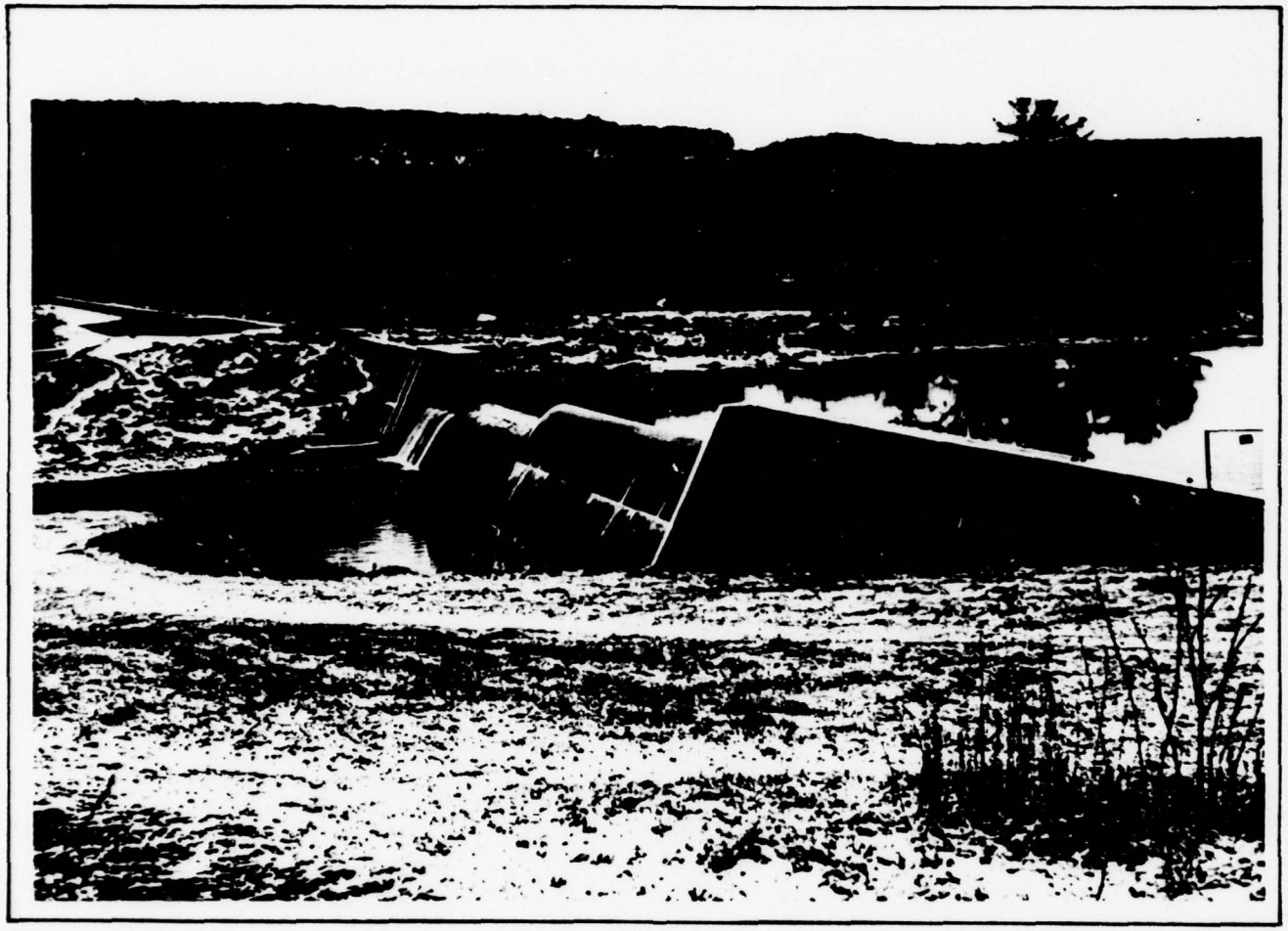
Will M. Heiser, P.E.
Vice-President
Pennsylvania Registration # 006926-E

Date: 3/15/79

APPROVED BY _____

G. K. WITHERS
Colonel, Corps of Engineers
District Engineer

Date: 11 Apr 79



OVERVIEW
SHOHOLA FALLS DAM, PIKE COUNTY, PENNSYLVANIA

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(Continued)

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
SHOHOLA MARSH RESERVOIR
NATIONAL ID #PA 00412
DER #52-158

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of this inspection is to evaluate the structural and hydraulic conditions of the Shohola Marsh Dam and appurtenant structures, and to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project

a. Dam and Appurtenances. (From information supplied by the Department of Environmental Resources, Commonwealth of Pennsylvania.) Shohola Marsh Reservoir has a concrete gravity dam approximately 800 feet long, with a maximum height of 34 feet. In order to utilize the lake at different surface levels, a combination of spillway openings has been provided.

The base of the dam is seated in rock a minimum depth of 2 feet. Because of fractures prevalent in the rock foundation, a grout curtain is provided along the upstream edge of the base of the dam.

The gravity overflow sections have a maximum height of approximately 25 feet with a base width, at this height, of 23 feet. The overflow sections are formed in an ogee shape. An energy dissipating roller bucket with an 8 foot radius is provided at the toe of the ogee sections. A 25-foot long basin is provided beyond the end of the roller bucket. The end of the basin slopes upward on a 1.5 horizontal to 1 vertical (1.5H:1V) slope in the direction of flow and is covered with a 2-foot blanket of riprap.

The non-overflow sections of the dam have a 3-foot top width. The upstream face batter varies from 1H:5V to 1H:20V. The downstream face slope varies from 1H:1.7V to 1H:4V.

At the right end of the concrete dam an earth fill embankment (maximum height 12 feet) is used to tie into the original ground. This fill has a 20 foot top width and side slopes of 3H:1V. A cut-off trench is extended into the rock foundation and the grout curtain is extended into this region.

The reservoir can be drawn down by means of a 3 foot wide by 4 foot high sluice gate located in the overflow section. The invert of this opening is Elev. 1140.0. The discharge from the sluice gate flows onto the roller bucket at the toe of the overflow section. Stop logs and a trash rack are provided upstream of the sluice gate.

b. Location. Shohola Marsh Reservoir was constructed across Shohola Creek at a point approximately 1000 feet south of the U.S. #6 (Roosevelt Highway) crossing of Shohola Creek in Dingman Township, Pike County, Pennsylvania. The site is approximately 13 miles east of Hawley, Pennsylvania and 10 miles west of Milford, Pennsylvania. The dam site is shown on USGS Quadrangle entitled, "Shohola, PA.-N.Y." at coordinates N41°23.4', W74°58.2'. A regional location plan of Shohola Marsh Reservoir is enclosed as Plate 1, Appendix E.

c. Size Classification. The dam is classified as an "Intermediate" size dam based on its storage capacity of 13,000 Ac. Ft.

d. Hazard Classification. The dam is classified as a "High" hazard structure. This is based on the potential in the event of failure for extensive property damage and possible loss of life. A number of homes are located within the flood plain approximately 1½ miles downstream of the structure.

e. Ownership. The dam is owned by the Pennsylvania Game Commission. All correspondence should be sent to Pennsylvania Game Commission, Mr. Glenn L. Bowers, Executive Director, South Office Building, P.O. Box 1567, Harrisburg, Pennsylvania, 17120

f. Purpose of Dam. The reservoir is used by the Pennsylvania Game Commission as a wild life habitat.

g. Design and Construction History. The application to construct Shohola Marsh Dam was submitted on November 15, 1966, by the Pennsylvania Game Commission. The "Report Upon the Application of the Pennsylvania Game Commission" was prepared on February 8, 1967, by the State of Pennsylvania. The permit to construct Shohola Marsh Dam was issued by the State of Pennsylvania on February 14, 1967.

Construction began on May 17, 1967. Correspondence located in the Department of Environmental Resources (DER) files indicates that it took 8 months to complete the first 20% of construction and only 6 additional months to complete the job. Foundation rock excavation was the item which caused the slow progress during the first 8 months of construction. The dam was officially completed July 31, 1968.

h. Normal Operating Procedures. The reservoir is normally maintained at Elevation 1154.0. By removing stop logs in the service spillway, the reservoir

can be lowered to Elevation 1151.0. By use of the 3 foot wide by 4 foot high sluice gate the impoundment can be lowered to Elevation 1140.0. The hoist for the sluice gate is located on the service bridge. The reservoir is lowered periodically to grow crops for water fowl feeding.

1.3 Pertinent Data

(From information supplied by Pennsylvania DER & USGS)

a. Drainage Area (sq. miles) — 54.0

b. Discharge at Dam Site (cfs)

Max. known flood at dam site Elev. 1158.0	2,770 in 1972 (Agnes)
Gated Spillway capacity at normal pool Elev. 1154.0	200
Gated Spillway capacity at maximum pool Elev. 1165.0	277
Ungated spillway capacity at maximum pool Elev. 1165.0	21,140

c. Elevation (Feet, USGS Datum)

Service spillway with stop logs removed	1151.0
Service spillway (normal pool)	1154.0
Lower emergency spillway	1158.0
Upper emergency spillway	1163.0
Top of dam	1165.0
Reservoir drain invert	1140.0
Service bridge floor	1165.0
Streambed at centerline of dam	1138.0
Maximum tailwater	1150.0±

d. Reservoir (miles)

Length of maximum pool	4.1
Length of normal pool	3.2
Fetch at normal pool	1.0

e. Storage (Acre-Feet)

Normal pool, Elev. 1154.0	12,610
Lower emergency spillway, Elev. 1158.0	17,270
Upper emergency spillway, Elev.1163.0	23,450
Top of dam, Elev.1165.0	26,450

f. Reservoir Surface (Acres)

Normal pool, Elev. 1154.0	1,137
Lower emergency spillway, Elev.1158.0	1,230
Upper emergency spillway, Elev.1163.0	1,340
Top of Dam, Elev.1165.0	1,380

g. Dam

Type	Concrete Gravity
Length	800 Ft.
Height	34 Ft. (maximum)
Top width	3 Ft. non-overflow sections
Side Slope	Refer to section 1.2.a
Grout curtain	Full length of dam to 40 feet below structure

h. Diversion and Regulating Tunnel
Does not apply to this site

i. Spillway

1)	Type	Concrete truncated ogee weir (with stoplogs)
	Length of weir	24.0 Ft.
	Crest elevation	1151.0
2)	Type	Concrete ogee weir
	Length of weir	68.0 Ft.
	Crest elevation	1154.0 Normal Pool
3)	Type	Concrete ogee weir
	Length of weir	100.0 Ft.
	Crest elevation	1158.0 Lower Emergency Spillway
4)	Type	Concrete square edge weir
	Length of weir	125.0 Ft.
	Crest elevation	1163.0 Upper Emergency Spillway

j. Regulating Outlets

Reservoir Drain	3 Ft. horizontal by 4 Ft. vertical sluice gate

SECTION 2

ENGINEERING DATA

2.1 Design

a. Data Available. A summary of engineering data on Shohola Marsh Reservoir is presented on the checklist attached as Appendix A. Principal documents obtained from DER containing pertinent data used for this report are as follows.

1. "Application", "Report Upon the Application", and "Permit" to construct Shohola Marsh Dam, DER, 1966-1967.

2. "Tabulation of Bids" to construct Shohola Marsh Dam issued March 29, 1967.

3. "Construction Progress Reports" prepared by Mr. Frederick Futchko, Project Engineer, Dam Section, Gannett Fleming Corddry and Carpenter, Inc. from, May 31, 1967, through August 7, 1968.

4. "Application for Permit to Draw Dam or Other Body of Water in Accordance with the Act of December 15, 1959" and approval of same for Shohola Marsh Reservoir.

5. Photographs made during construction and at the final inspection.

6. Complete set of construction drawings.

Note: Design data is not available.

b. Design Features. The principal design features for the structure are shown on the drawings enclosed in Appendix E as Plates 1 through 6. A description of the features is discussed in Section 1.2.a.

2.2 Construction

Based on the documentation in the DER files and the construction drawings, supplemented by discussion with the Owner's representative, it is concluded that the dam was constructed as designed. Gannett Fleming Corddry and Carpenter Inc. of Harrisburg, Pennsylvania was the designer and construction manager. Burly Construction Corporation, Hewitt, New Jersey, was the contractor.

2.3 Operation Data

There are no formal operating procedures for the dam. A 24-foot length of the service spillway varies in elevation between Elev. 1151.0 and Elev. 1154.0 with the placing or removing of stop logs. Minimum flow requirements are maintained through the 3-foot horizontal by 4-foot vertical reservoir drain gate which has an invert elevation of 1140.0

2.4 Evaluation

a. Availability. All engineering data reproduced in this report and studied for this investigation were provided by DER and supplemented by conversations with the Owner's representative.

b. Adequacy. The entire design folder is not available for review. Reasonably accurate stability analyses were made using the information provided by DER. The drawings are legible and complete, and the dam appears to be constructed in general conformance with the drawings.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The observations and comments of the field inspection team are in the checklist which is Appendix B of this report. The appearance of the facility indicates that the dam and its appurtenances were constructed in accordance with the drawings. They are well maintained and in good condition. No underwater areas were inspected.

b. Dam. Some hairline cracking of the concrete was noted. There were no significant indications or evidence observed of distortions in vertical or horizontal alignment or grade that would indicate movement of the dam. The sixth section of the dam from the right abutment bows out slightly in the downstream face from the rest of the dam. This may have been due to the arrangement of formwork during construction.

c. Appurtenant Structures. A railing was broken on the stairs to the service bridge. The Game Commission representative assured us this would be welded. The service bridge platform has a difference in elevation of about $\frac{1}{2}$ inch in adjoining portions of the concrete floor. The floor may have been poured that way during construction.

d. Reservoir. Reconnaissance of the reservoir disclosed no evidence of significant siltation, slope instability, or other features that would significantly affect the storage capacity of the reservoir. The slopes on the perimeter of the reservoir are mild and well vegetated.

e. Downstream Conditions. Approximately 60 yards downstream of the dam the flow drops over Shohola Falls which is about 40 feet high. U.S. route 6 crosses over the creek about 1,000 feet downstream of the dam. The highway bridge offers no restriction to flow because the creek is in a deep gorge and clearance for the bridge is at least 70 feet. From the falls to approximately 1-1/4 miles downstream of the falls, the creek flows through a deep gorge on a slope in excess of 4%. In the event of failure, the next 9 miles would be the potential damage region. The channel gradient is approximately 0.7% in this reach. Slopes are vegetated, generally stable, and in good condition.

3.2 Evaluation

No serious deficiencies were observed during the Phase I Visual Inspection.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures

The Pennsylvania Game Commission has written operating procedures which are covered in Section 1.2.h. Normal operating procedures for this structure do not require a dam tender.

4.2 Maintenance of the Dam

The dam is maintained by the Pennsylvania Game Commission. Normal maintenance is reported to consist of keeping the spillways free of all debris, keeping vegetation cut in the vicinity of the dam, and constantly being alert for possible deterioration of the structure.

4.3 Maintenance of Operating Facilities

The operating facilities are maintained by the Pennsylvania Game Commission. Normal maintenance is reported to consist of annually creosoting the service spillway stop logs and cleaning and lubricating the reservoir drain gate system. The Game Commission has written maintenance procedures.

4.4 Warning System in Effect

There is no formal warning system or procedure established to be followed during periods of exceedingly heavy rainfall. However, it is understood that a representative of the Game Commission is always in the vicinity and available to warn downstream residents of impending high flows.

4.5 Evaluation

The operation and maintenance procedures are satisfactory for the Shohola Marsh Reservoir. A formal warning system should be implemented because of the possibility of loss of life and significant property damage downstream in the event of a failure of the structure.

The representative of the Game Commission told us that the reservoir drain gate is operated on a regular schedule. He would have operated the gate hoist, but he did not have the crank for the hoist with him.

The dam is accessible under all weather conditions for inspection and emergency action.

SECTION 5

HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features

a. Design Data. The original design information is limited to statements in the Application Report dated February 8, 1967.

Shohola Marsh Reservoir's watershed is about 12 miles long and averages about 5 miles wide, with a total drainage area of 54 square miles. Elevations range from 2000 to 1154 at normal reservoir level. The slope of the watershed adjacent to the reservoir is about 10 percent. The watershed is nearly 100 percent wooded. Portions of the watershed are State Game Lands and State Forests while the balance of the watershed is open to private development. The runoff characteristics of the watershed may undergo change in the future as a result of private development.

The spillway was designed to have a maximum discharge of 21,950 cfs., the "C" curve criterion for this drainage area as specified by DER.

b. Experience Data. Rainfall and water level records are not kept for this dam. The Game Commission representative said that during Tropical Storm Agnes (June, 1972), the water reached elevation 1158.0, the crest of the lower emergency spillway. This corresponds to a discharge of approximately 2,800 cfs (assuming the stoplogs were in place).

c. Visual Observations. On the day of the inspection, there were no indications that the spillways of the dam would be obstructed, or would not operate satisfactorily in the event of a storm.

d. Overtopping Potential. The PMF hydrograph was routed through the reservoir with the starting water surface elevation at the crest of the service spillway (Elev. 1154.0). The inflow and outflow peaks for the PMF are 52,070 cfs and 39,804 cfs respectively. The PMF would overtop the dam by approximately 3 feet. Review of the hydrologic analysis indicates that the spillway system is capable of passing approximately 63 percent of the PMF without overtopping of the non-overflow portions of the dam. Refer to Appendix C for computations.

e. Spillway Adequacy. The spillway system is classified as "inadequate" for discharge of the Spillway Design Flood. The spillway system is not "seriously inadequate" since the spillway can adequately discharge more than 50 percent of the PMF.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations. No structural inadequacies were noted during the visual inspection of the dam. However, some minor surface cracking of the concrete was noted on the non-overflow sections. A complete inspection was not possible due to the overflow conditions.

b. Design & Construction Data. All available material was reviewed. Detailed listing of this data is included in Appendix A and is discussed in Section 2.

The service spillway and the lower emergency spillway are ogee sections. The shape of the crest is such that for heads associated with flows in excess of 30 percent of the PMF, the lower nappe of the overflow can be expected to separate from the spillway face, producing negative pressures on the downstream face of the dam. For discharges in excess of 50 percent of the PMF, cavitation may result. The area of subatmospheric pressure along the downstream face of the structure also adds to the overturning effect of the dam. Analysis of the effect of these negative pressures is beyond the scope of this report and are not included in the calculations, Appendix G.

c. Operating Records. There are no operating records maintained for this structure.

d. Post-Construction changes. There are no reports nor is there any evidence that modifications were made to this dam.

e. Seismic Stability. The dam is located in Seismic Zone 1 of the "Seismic Zone Map of Contiguous States". Normally it can be considered that if a dam in this zone is stable under static loading conditions it can be assumed safe for any expected earthquake conditions. Refer to the following paragraph for stability evaluations of various static loading conditions.

f. Evaluation. Stability analyses of the dam for the entire overflow portion and a typical section of the non-overflow portion show that the stability requirements for overturning are not met: the foundation reaction is not in the middle third of the base for discharges ranging from normal flow with ice load to the PMF event. The computer printouts for the stability analyses are included in Appendix G.

SECTION 7

ASSESSMENT, RECOMMENDATIONS, PROPOSED REMEDIAL MEASURES

7.1 Dam Assessment

a. Evaluation. The visual inspection and review of the material supplied by DER indicates that the structure is in good condition and was built in general conformance with the drawings.

Examination of the hydrologic and hydraulic calculations shown in Appendix C indicate that the spillway system will pass about 63 percent of the PMF. Therefore, the spillway system of the structure is considered to be "Inadequate". As pointed out in paragraph 6.1.b, cavitation may develop during flows exceeding 50 percent of the PMF.

The foundation reaction is not in the middle third of the base for the entire overflow portion and typical section taken in the non-overflow portion of the dam. This is true for discharges ranging from normal flow with ice load to the PMF event.

b. Adequacy of Information. The available information along with visual observations are considered to be sufficient to make a reasonable assessment of the dam. The design folder was not made available for review.

c. Urgency. The recommendations presented in Section 7.2 should be implemented immediately.

d. Necessity for Further Investigation. Further detailed stability and hydrologic and hydraulic studies should be performed to determine if remedial measures are necessary at this time.

7.2 Recommendations, Remedial Measures

a. Facilities.

1) The owner should take necessary action to supplement file records of this dam to include stability analyses indicating the structure's capability to resist sliding, overturning and overstressing when subject to water levels where failure would significantly increase potential for loss of life downstream.

2) Recommendations to strenghten the dam would depend on the results of further detailed stability analyses.

3) Measures should be taken to protect the downstream surface of the overflow sections to prevent damage associated with cavitation.

b. Operation & Maintenance Procedures.

1) In the event of failure there could be extensive property damage and possible loss of life downstream. Therefore, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented. This procedure should include a method of warning downstream residents that high flows are expected along the creek. If abnormally high flows are expected, procedures for evacuating people within the flood plain should be implemented.

2) The dam should be inspected on a yearly basis.

APPENDIX

A

Check List Engineering Data

Design, Construction, Operation

Phase I

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Shohola Marsh Reservoirs

ID # PA 00412

ITEM	REMARKS
AS-BUILT DRAWINGS	There are no "As-Built" drawings, but DER files have an 11 sheet full size set of construction drawings.
REGIONAL VICINITY MAP	See Plate 1, Appendix E.
CONSTRUCTION HISTORY	GFC&C's Project Engineer, Dam Section provided progress reports of the construction and these reports are in DER files.
TYPICAL SECTIONS OF DAM	Provided by GFC&C. See Appendix E for drawings.
OUTLETS - PLAN	See Appendix E for drawings.
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	None available
RAINFALL/RESERVOIR RECORDS	None available

ITEM	REMARKS
DESIGN REPORTS	Design drawings were prepared by GFC&C (1966) 11/11 sheets were in DER files.
GEOLOGY REPORTS	None provided in DER files. See Appendix F of this report.
DESIGN COMPUTATIONS	No data available
HYDROLOGY & HYDRAULICS	No data available
DAM STABILITY	No data available
SEEPAGE STUDIES	No data available
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Complete set of logs of drill holes and test pits are part of the set of drawings.
POST-CONSTRUCTION SURVEYS OF DAM	None
BORROW SOURCES	Concrete gravity overflow dam. Enbankment material taken from within work area limits. It is only needed for abutment tie-ins.

ITEM	REMARKS
MONITORING SYSTEMS	None
MODIFICATIONS	None
HIGH POOL RECORDS	None. Game Commission representative noted that highest water level has been to the crest of the lower Emergency Spillway (El.1158.0) during Agnes in 1972.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None
MAINTENANCE OPERATION RECORDS	Records are kept in Pennsylvania Game Commission files.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	See Appendix E for details
OPERATING EQUIPMENT PLANS & DETAILS	See Appendix E for details
MISCELLANEOUS Material in DER files	1. "Application" to construct Shohola Marsh Reservoir issued November 15, 1966. 2. "Report upon the Application of the Pennsylvania Game Commission" by Joseph J. Ellam, Hydraulic Engineer, DER, dated February 8, 1967. 3. "Permit" to construct Shohola Marsh Reservoir issued February 14, 1967. 4. "Tabulation of Bids" to construct Shohola Marsh Reservoir issued March 29, 1967. 5. "Construction Progress Reports" prepared by Mr. Frederick Futchko, Project Engineer, Dam Section, GFC&C, Inc. from May 31, 1967 through August 7, 1968. 6. "Application for Permit to Draw Dam or Other Body of Water in Accordance with the Act of December 15, 1959." and approval of same for Shohola Marsh Reservoir. 7. Photographs made during construction and at the final inspection.

APPENDIX

B

Check List

Visual Inspection

Phase I

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam Shohola Marsh Reservoir County Pike State Pennsylvania National ID # PA 00412

Type of Dam Concrete Gravity Hazard Category High

Date(s) Inspection 11-22-78 Weather Cold, Cloudy Temperature 30°-35°-F

Pool Elevation at Time of Inspection ±1154.5 M.S.L. Tailwater at Time of Inspection ±1140.0 M.S.L.

Inspection Personnel:

George Elias David Campbell

Leonard Beck Robert Bowers

Leonard Beck Recorder

Remarks:

Mr. Wilmer R. Peoples, Land Manager, Pennsylvania Game Commission accompanied us and answered questions during our inspection.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	No leakage observed since flow over the service spillway was occurring at the time of inspection.	Should be inspected when no flow is occurring over the spillways.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	No problems	None
DRAINS	Could not be seen under water in roller buckets	3" diam. drain holes 10' c.c. in the roller bucket of both the service & lower emergency spillways shown on drawings.
WATER PASSAGES	None	None
FOUNDATION	Sandstone and shale outcrops around dam & in creek channel downstream.	As shown on the drawings the dam is built a minimum of 2 feet into the shale and sandstone foundation.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	Minor cracking in non-overflow sections of the dam on both the left and right side.	The service spillway could not be investigated because of flow over it.
STRUCTURAL CRACKING	None observed	Same as above
VERTICAL AND HORIZONTAL ALIGNMENT	Slight varience in horizontal alignment probably due to forming during construction.	None
MONOLITH JOINTS	No problems	None
CONSTRUCTION JOINTS	No problems	None

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed	None
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	None
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed	None
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No distortions observed	None
RIPRAP FAILURES	None observed	None

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
Drains	None	None
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No discontinuities observed	None
ANY NOTICEABLE SEEPAGE	None observed	None
STAFF GAGE AND RECORDER	None	None

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	None observed	None
INTAKE STRUCTURE	Under water at time of investigation	Trash rack protection shown on drawings.
OUTLET STRUCTURE	No obstructions to flow noted	None
OUTLET CHANNEL	No problems observed	None
EMERGENCY GATE	under water at time of Investigation	3' horizontal by 4' vertical sluice gate shown on drawings.

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	There were no obstructions for the service and the emergency spillways.	Refer to section 7.2 for suggested measures to be taken for high flows over both the service and emergency spillway weirs.
APPROACH CHANNEL	There were no obstructions for the service and the emergency spillways.	None
DISCHARGE CHANNEL	There were no obstructions for the service and the emergency spillways	None
BRIDGE AND PIERS	There's about a ½" difference in the pours of the floor of the service bridge.	This probably happened when the floor was poured.

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None	None
OBSERVATION WELLS	None	None
WEIRS	None	None
PIEZOMETERS	None	None
OTHER	None	None

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gentle slopes, heavily vegetated, no signs of slides	None
SEDIMENTATION	Insignificant	None

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The channel flows through a steep rocky gorge for the first 1-1/4 miles downstream of the dam. From the gorge to the Delaware River the creek flows through a boulder strewn valley.	None
SLOPES	Through the gorge, the channel slope in better than 4%. Downstream of the gorge the channel gradient is about 0.7%. Where observed the side slopes appear stable.	None
APPROXIMATE NO. OF HOMES AND POPULATION	There are at least 11 homes in the flood plain area downstream of dam (Approx. 50 people)	A formal warning system should be develqped & implemented. Procedures for evacuating people within the flood plain should be implemented.

APPENDIX

C

Hydrologic & Hydraulic Data

O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
Shohola Marsh Dam				

TABLE OF CONTENTS APPENDIX C

Hydrologic & Hydraulic Data

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO.
SHOHOLA FALLS DAM	1	RRB	1/12/79	

V# 1/23/79

HEC 1, DAM SAFETY VERSION PROGRAM CALCULATIONS

DRAINAGE AREA : 54 SQUARE MILES

PMP CALCULATIONS (HMS REPORT 33)

AREA IS IN ZONE 1 OF PMP ALL SEASON ENVELOPE (FIG. 1)

24 HR., 200 SQ. MI. RAINFALL ≅ 22"

HR	%	RAINFALL	ΔRF
6	91	20.0"	20.0"
12	105	23.1"	3.1"
24	115	25.3"	2.2"
48	122	26.8"	1.5"

SNYDER COEFFICIENTS

FROM INFO. PROVIDED BY COE (BALT. DISTRICT) ZONE #1

$$C_p = 0.45$$

AND $C_t = 1.23$

$$t_p = C_t (L \cdot L_{ca})^{0.3}$$

$L \approx 17.5$ miles $\qquad L_{ca} \approx 5.7$ miles

$$t_p = 1.23 (17.5 \cdot 5.7)^{0.3} = 4.89 \text{ HR.}$$

O'BRIEN & GERE ENGINEERS, INC.

O'BRIEN & GERE ENGINEERS, INC.

SUBJECT: Thomas Marsh Dam, Stage vs. Discharge | SHEET | BY | DATE 11/30/78 | JOB NO 52-156 | SUBJECT | SHEET 2 | BY | DATE

Checked by DBC

C for square edged weir = 3.10 & C for ogee weir = 4.0 (Chow, Open Channels)

℄ Elev. 1154.0 Square edged weir 24'long, $CL_{S24} = 3.1 \times 24 = 74.4$

℄ Elev. 1154.0 Ogee Weir 68'long, $CL_{O68} = 4.0 \times 68 = 272.0$

℄ Elev. 1153.0 Ogee Weir 100'long, $CL_{O100} = 4.0 \times 100 = 400.0$

℄ Elev. 1163.0 Square edged weir 125'long. $CL_{S63} = 3.1 \times 125 = 387.5$

℄ Elev. 1165.0 Square edged weir 216'long. $CL_{S65} = 3.1 \times 216 = 670.0$

℄ Elev. 1166.5 Square edged weir (Assumed) 230'lg. $CL_{S66.5} = 3.1 \times 230 = 713.0$

$L = 17.5$ miles

$L_{ca} \approx 5.7$ miles

Elev.	Square edged weir ℄ El. 1154.0, $CL_{S24} = 74.4$			Ogee weir ℄ El. 1154.0 $CL_{O68} = 272.0$			Ogee weir ℄ El. 1153.0 $CL_{O84} = 400.0$			Square edged weir ℄ El. 1163.0, $CL_{S63} = 387.5$			Square edged weir ℄ El. 1165.0, $CL_{S65} = 670.0$			Square edged weir ℄ El. 1166.5, $CL_{S66.5} = 713.0$			Total Q c.f.s.
	h_{S24}	$h_{S24}^{3/2}$	Q_{S24}	h_{O68}	$h_{O68}^{3/2}$	Q_{O68}	h_{O84}	$h_{O84}^{3/2}$	Q_{O84}	h_{S63}	$h_{S63}^{3/2}$	Q_{S63}	h_{S65}	$h_{S65}^{3/2}$	Q_{S65}	$h_{S66.5}$	$h_{S66.5}^{3/2}$	$Q_{S66.5}$	
1154.0	0	0	0	0	0	0													0
1154.5	0.5	0.354	26	0.5	0.354	96													122
1155.0	1.0	1.0	74	1.0	1.0	272													346
1156.0	2.0	2.83	211	2.0	2.83	770													981
1158.0	4.0	8.0	595	4.0	8.0	2176	0	0	0										2771
1158.5	4.5	9.55	711	4.5	9.55	2598	0.5	0.35	140										3449
1159.0	5.0	11.18	832	5.0	11.18	3041	1.0	1.0	400										4273
1160.0	6.0	14.70	1094	6.0	14.70	3998	2.0	2.83	1132										6224
1161.5	7.5	20.54	1528	7.5	20.54	5587	3.5	6.55	2620										9735
1163.0	9.0	27.0	2007	9	27.0	7344	5.0	11.18	4472	0	0	0							13823
1163.5	9.5	29.28	2178	9.5	29.28	7964	5.5	12.90	5160	0.5	0.35	136							15438
1164.0	10.0	31.62	2353	10.0	31.62	8601	6.0	14.70	5880	1.0	1.0	388							17222
1165.0	11.0	36.48	2714	11.0	36.48	9923	7.0	18.52	7408	2.0	2.83	1097	0	0	0				21142
1166.0	12.0	41.57	3093	12.0	41.57	11307	8.0	22.62	9051	3.0	5.20	2014	1.0	1.0	670				26135
1166.5	12.5	44.19	3288	12.5	44.19	12020	8.5	24.78	9912	3.5	6.55	2538	1.5	1.84	1233	0	0	0	28991
1168.0	14.0	52.38	3897	14.0	52.38	14247	10.0	31.62	12648	5.0	11.18	4332	3.0	5.20	3484	1.5	1.84	1312	39920
1169.0	15.0	58.09	4322	15.0	58.09	15800	11.0	36.48	14592	6.0	14.70	5696	4.0	8.0	5360	2.5	3.95	7816	48586

Reservoir Drain Discharge (Orifice Flow)

$Q = CAV\sqrt{2gH}$

$Q = 0.6 \times 12 \times 8.02 \times H^{1/2}$

$Q = 57.74\, H^{1/2}$

$C = 0.60$

$A = 12.0$ ft²

$g = 64.4$

Spillway El. 1142.0

Q @ Elev. 1154.0

$Q = 57.74 \times \sqrt{12}$

$Q = 200$ c.f.s.

Q @ Elev 1165.0

$Q = 57.74\sqrt{23}$

$Q = 277$ c.f.s.

9h 3

```
***********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  25 SEP 78
***********************************
A1                        NATIONAL DAM INSPECTION PROGRAM
A2                                SHOHOLA FALLS DAM
A3                                 PMF HYDROGRAPH
B     100       1       0       0       0       0       0       0      -4       0
H1      5
J       1       9       1
J1    0.2     0.3     0.4     0.5     0.6     0.7     0.8     0.9     1.0
K       0      A1                                       1
K1                              RUNOFF TO RESERVOIR
M       1       1      54                                                       1
P       0      22      91     105     115     122
T                                                     1.0    0.05
W    4.89    0.45
X    -1.5    -.05       2
K       1      A2                                       1
K1                            ROUTING THROUGH RESERVOIR
Y                               1       1
Y1      1                                           12730      -1
Y4   1154  1154.5    1155    1156    1158  1158.5    1159    1160  1161.5    1163
Y41163.5     1164    1165    1166    1168    1170
Y5      0     122     346     981    2771    3449    4273    6224    9735   13825
Y5  15438   17222   21142   25465   35124   45974
$S      0    3090    7590   12730   17360   23640   26480   34180
$E   1139    1144    1149    1154    1158    1163    1165    1170
$$   1154
$D   1165     3.1     1.5     230
K      99
```

```
**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  25 SEP 78
**********************************

RUN  DATE= 03/07/79.
     TIME= 12.34.19.
```

SH 4

NATIONAL DAM INSPECTION PROGRAM
SHOMOLA FALLS DAM
PMF HYDROGRAPH

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
100	1	0	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

RTIOS=	.20	.30	.40	.50	.60	.70	.80	.90	1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

RUNOFF TO RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	54.00	0.00	54.00	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	22.00	91.00	105.00	115.00	122.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .852

LOSS DATA

LRUPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 4.89 CP= .45 NTA= 0

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 44 END-OF-PERIOD ORDINATES, LAG= 4.94 HOURS, CP= .45 VOL= 1.00

251.	929.	1851.	2699.	3187.	3151.	2797.	2453.	2152.	1888.
1656.	1462.	1274.	1117.	980.	859.	754.	661.	580.	509.
446.	391.	343.	301.	264.	232.	203.	178.	156.	137.
120.	105.	93.	81.	71.	62.	55.	48.	42.	37.
32.	28.	25.	22.						

Q
END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	22.86	20.50	2.36	728391.
										(581.)	(521.)	(60.)	(20625.74)

********** ********** ********** ********** **********

Sh 5

HYDROGRAPH ROUTING

ROUTING THROUGH RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A2	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	12730.	-1

STAGE	1154.00	1154.50	1155.00	1156.00	1158.00	1158.50	1159.00	1160.00	1161.50	1163.00
	1163.50	1164.00	1165.00	1166.00	1168.00	1170.00				
FLOW	0.00	122.00	346.00	981.00	2771.00	3449.00	4273.00	6224.00	9735.00	13825.00
	15438.00	17222.00	21142.00	25465.00	35124.00	45974.00				
CAPACITY=	0.	3090.	7590.	12730.	17360.	23640.	26480.	34180.		
ELEVATION=	1139.	1144.	1149.	1154.	1158.	1163.	1165.	1170.		

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
1154.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
1165.0	3.1	1.5	230.

PEAK OUTFLOW IS 4596. AT TIME 52.00 HOURS

PEAK OUTFLOW IS 8184. AT TIME 51.00 HOURS

PEAK OUTFLOW IS 11969. AT TIME 50.00 HOURS

PEAK OUTFLOW IS 15887. AT TIME 50.00 HOURS

PEAK OUTFLOW IS 20098. AT TIME 49.00 HOURS

PEAK OUTFLOW IS 24629. AT TIME 49.00 HOURS

PEAK OUTFLOW IS 29411. AT TIME 49.00 HOURS

PEAK OUTFLOW IS 34366. AT TIME 48.00 HOURS

PEAK OUTFLOW IS 39804. AT TIME 48.00 HOURS

Sh 6

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

				RATIOS APPLIED TO FLOWS								
OPERATION	STATION	AREA	PLAN	RATIO 1 .20	RATIO 2 .30	RATIO 3 .40	RATIO 4 .50	RATIO 5 .60	RATIO 6 .70	RATIO 7 .80	RATIO 8 .90	RATIO 9 1.00
HYDROGRAPH AT	A1	54.00 (139.86)	1	10414. (294.89)	15621. (442.34)	20828. (589.78)	26035. (737.23)	31242. (884.67)	36449. (1032.12)	41656. (1179.56)	46863. (1327.01)	52070. (1474.45)
ROUTED TO	A2	54.00 (139.86)	1	4596. (130.13)	8184. (231.73)	11969. (338.92)	15887. (449.86)	20098. (569.12)	24629. (697.42)	29411. (832.83)	34366. (973.14)	39804. (1127.11)

SUMMARY OF DAM SAFETY ANALYSIS

Sh 7

PLAN 1 .....

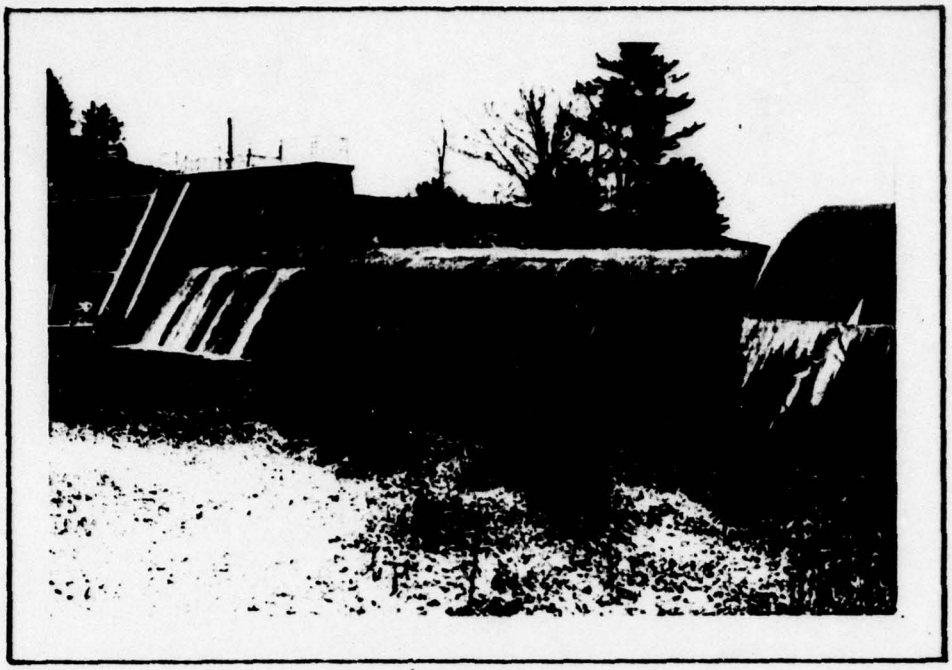
	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	1154.00	1154.00	1165.00
STORAGE	12730.	12730.	26480.
OUTFLOW	0.	0.	21142.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	1159.17	0.00	18824.	4596.	0.00	52.00	0.00
.30	1160.84	0.00	20923.	8184.	0.00	51.00	0.00
.40	1162.32	0.00	22785.	11969.	0.00	50.00	0.00
.50	1163.63	0.00	24529.	15887.	0.00	50.00	0.00
.60	1164.73	0.00	26102.	20098.	0.00	49.00	0.00
.70	1165.71	.71	27571.	24629.	6.00	49.00	0.00
.80	1166.54	1.54	28846.	29411.	9.00	49.00	0.00
.90	1167.32	2.32	30054.	34366.	11.00	48.00	0.00
1.00	1168.05	3.05	31184.	39804.	12.00	48.00	0.00

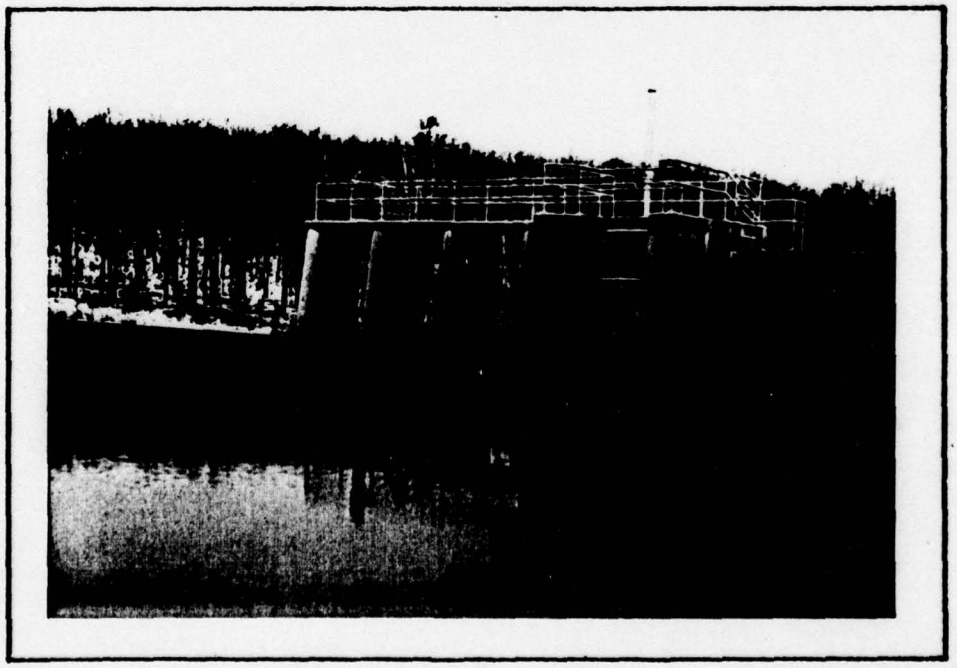
APPENDIX

D

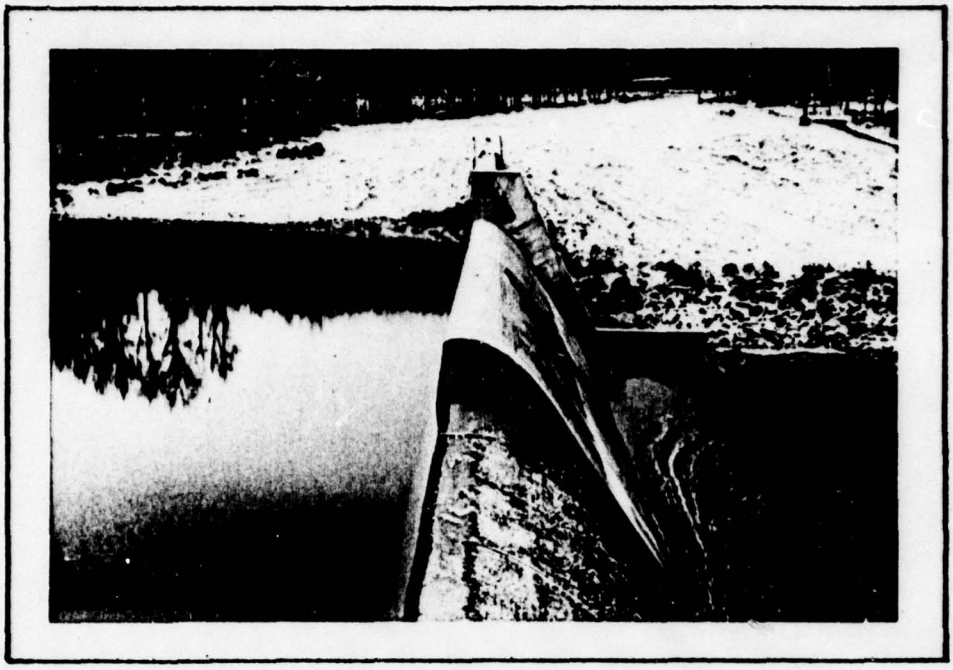
Photographs



SERVICE SPILLWAY WITH STOPLOG
CONTROLLED PORTION TO THE LEFT

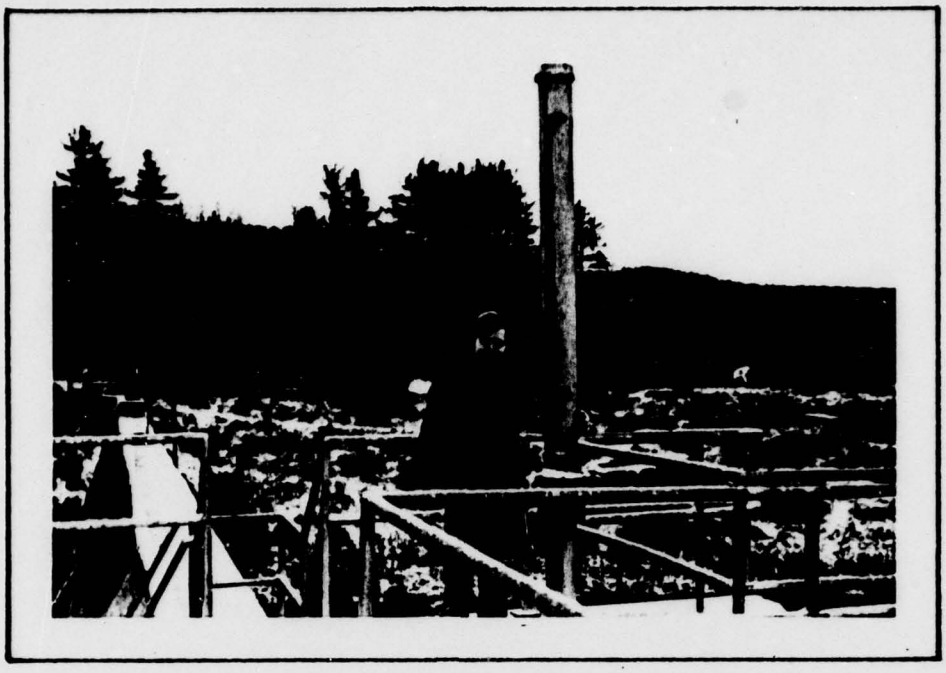


UPSTREAM VIEW OF SERVICE
SPILLWAY AND OUTLET WORKS



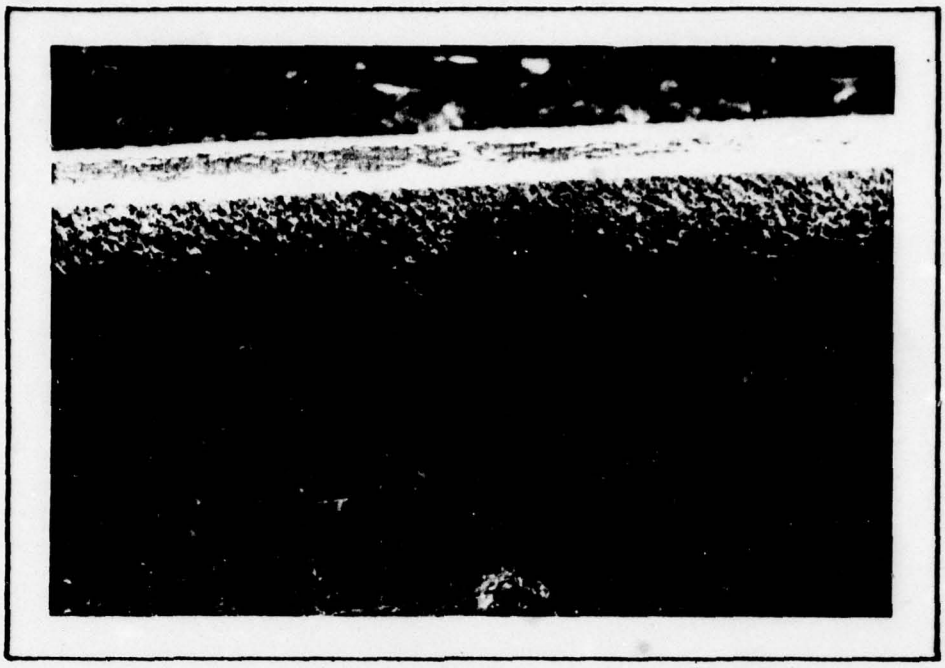
SERVICE SPILLWAY AND LOWER EMERGENCY SPILLWAY LOOKING TOWARDS LEFT ABUTMENT

UPSTREAM VIEW OF DAM



ON SERVICE BRIDGE SHOWING
RESERVOIR DRAIN HOIST AND STEM

RESERVOIR DRAIN AND STOP LOGGED
PORTION OF SERVICE SPILLWAY



TYPICAL MINOR SURFACE CRACKING

FALLS OF SHOHOLA CREEK ABOUT 100 YARDS DOWNSTREAM OF THE DAM

GORGE 300 YARDS DOWNSTREAM OF DAM

CHANNEL 3 MILES DOWNSTREAM OF DAM

APPENDIX

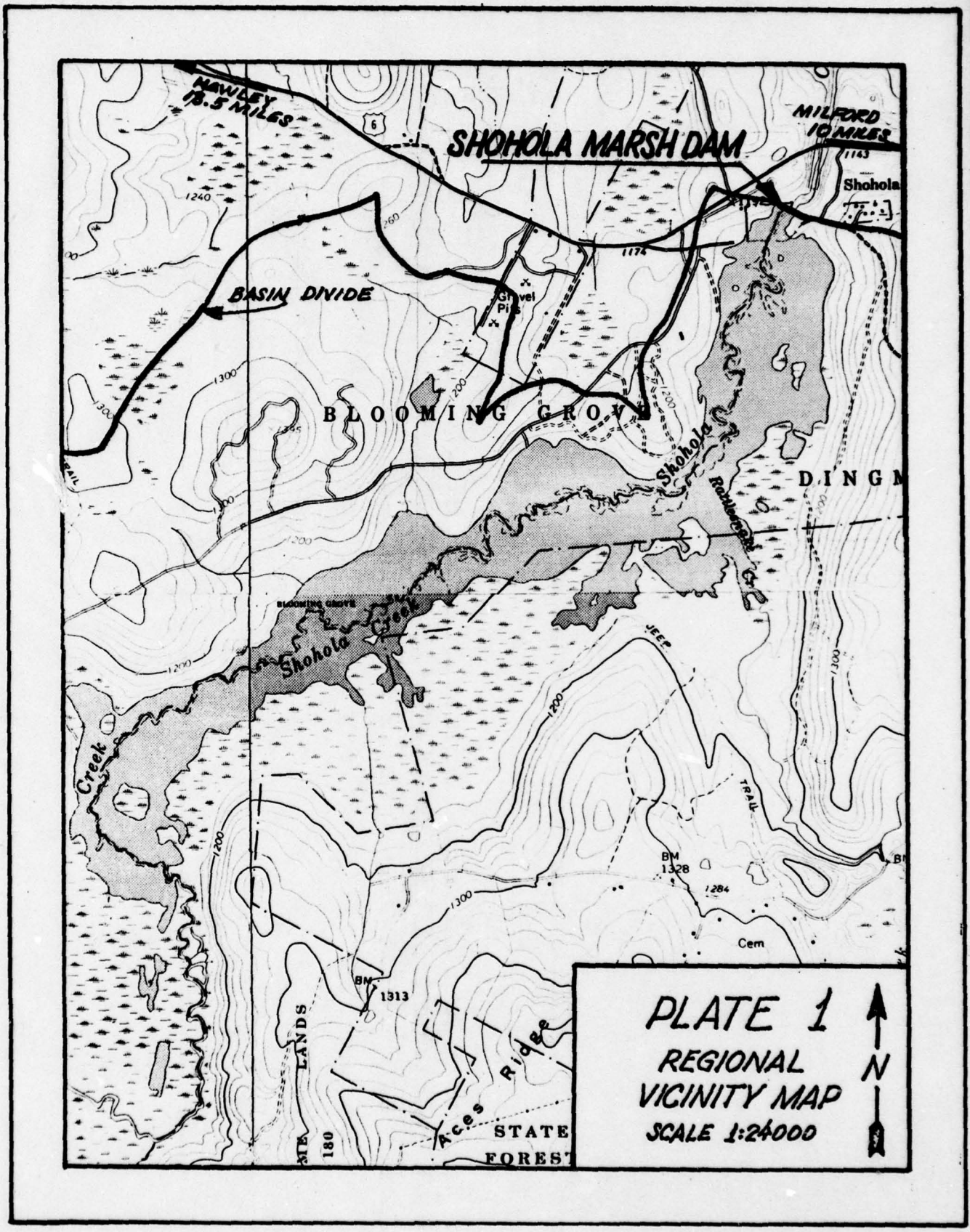
E

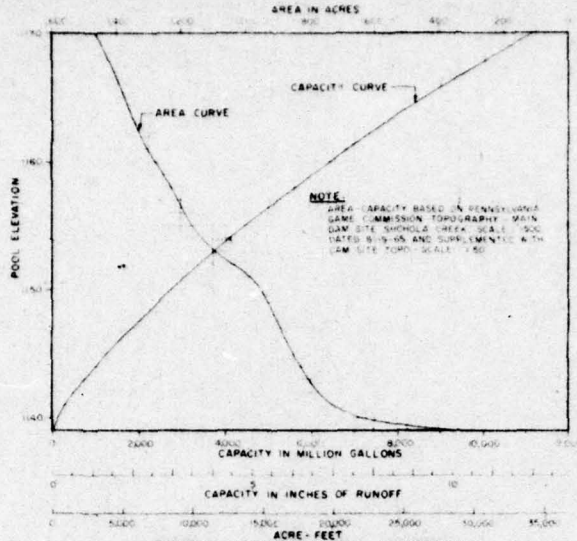
Drawings

O'BRIEN & GERE ENGINEERS, INC.

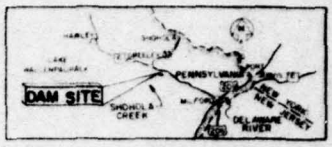
SUBJECT	SHEET	BY	DATE	JOB NO
Shotola Falls Dam				

Table of Contents APPENDIX E


HAWLEY
18.5 MILES
SHOHOLA MARSH DAM
MILFORD
10 MILES
Shohola
BASIN DIVIDE
Gravel Pits
BLOOMING GROVE
Shohola
Creek
Rattlesnake Gr.
JEEP
TRAIL
BM
1328
1284
Cem
BM
1313
ACES Ridge
STATE
FOREST
PLATE 1
REGIONAL
VICINITY MAP
SCALE 1:24000
N

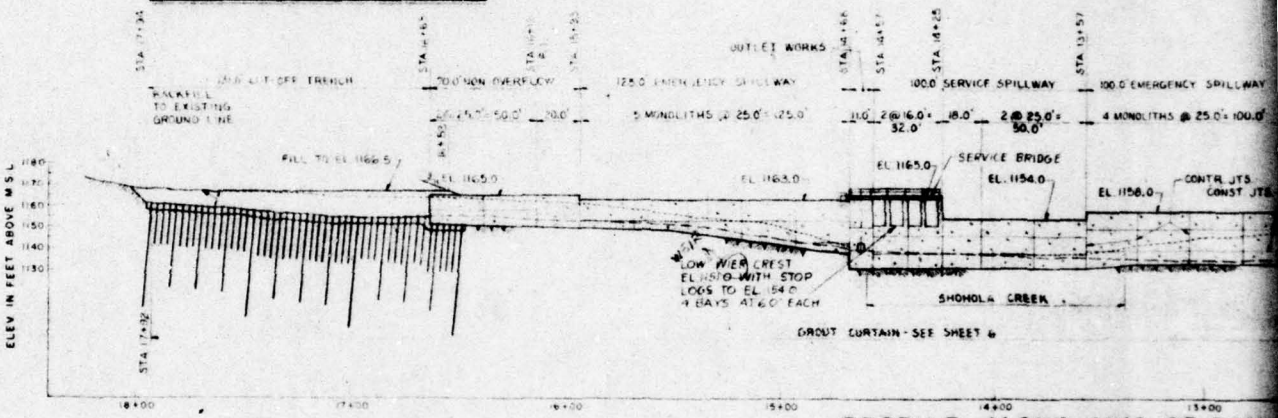


AREA-CAPACITY CURVES



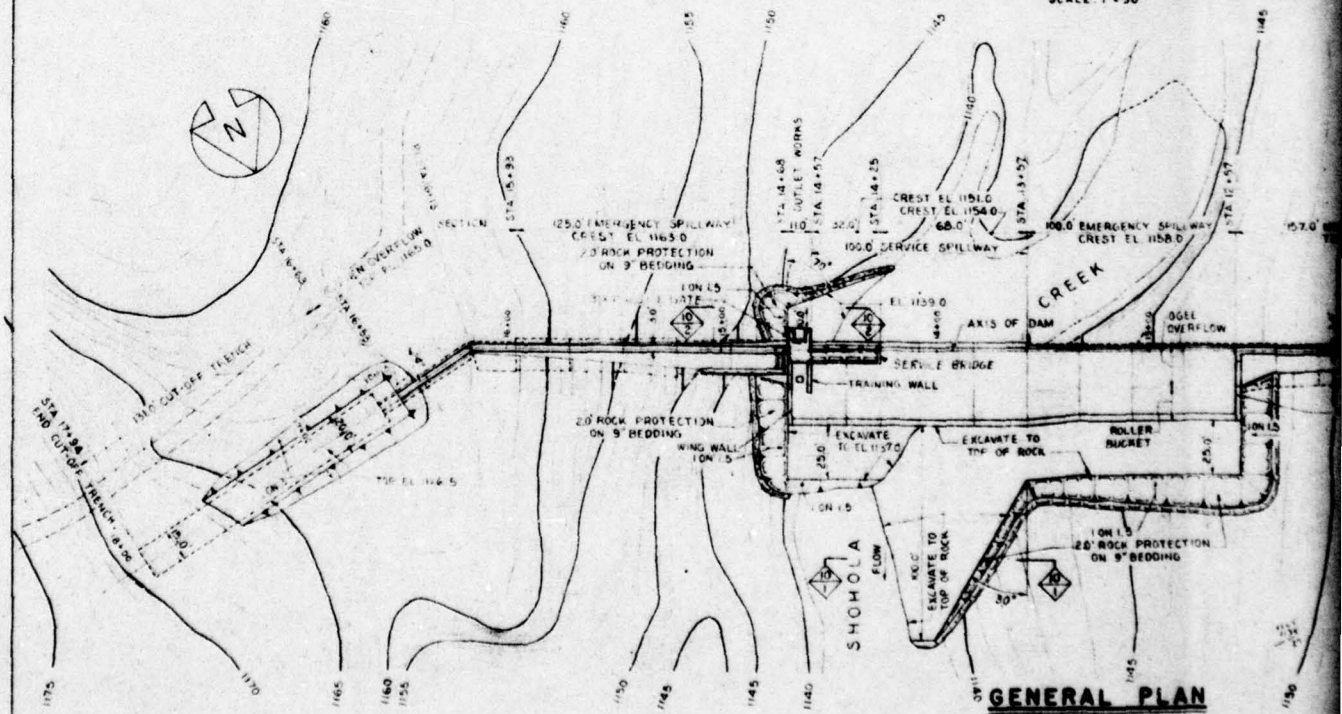
LOCATION MAP

SCALE 1 IN = 1075 MI



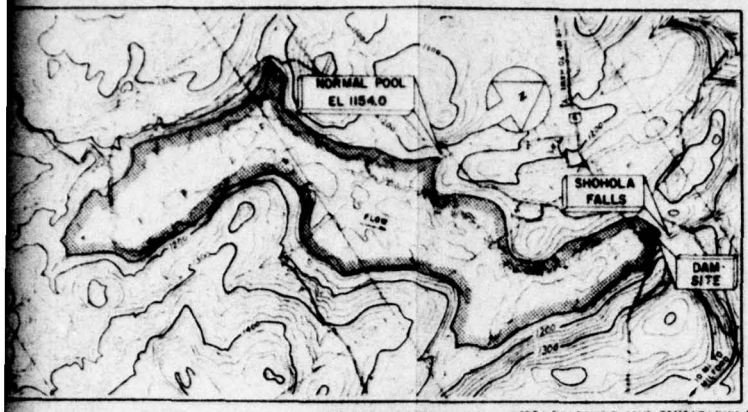
PROFILE ALONG AXIS OF DAM

SCALE 1" = 30'



GENERAL PLAN

SCALE: 1" = 30'



RESERVOIR MAP

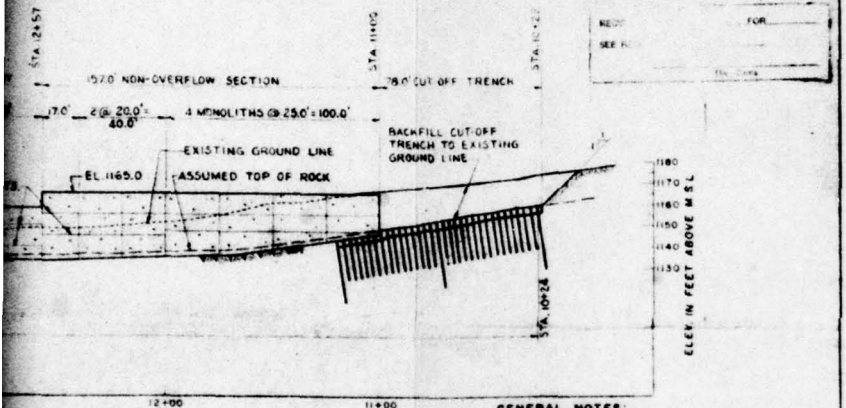
2000' 1000' 0 2000' 4000'
SCALE 1" = 2000'

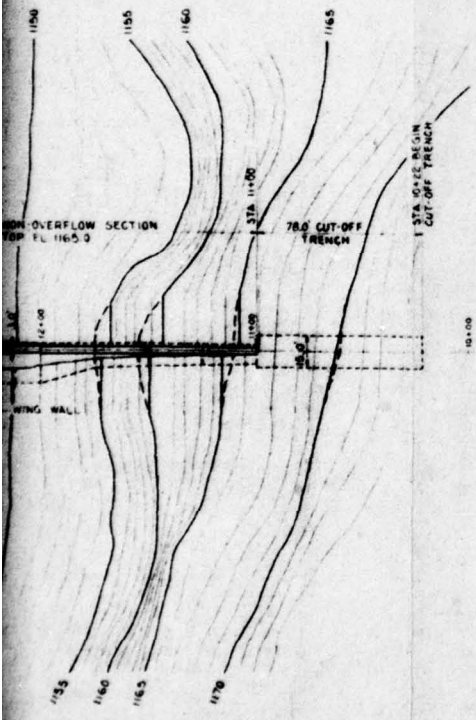
NOTE: RESERVOIR MAP TOPOGRAPHY BASED ON PROVISIONAL MAPS BY U.S. GEOLOGICAL SURVEY

57-158-2

RECEIVED ... THE WATER & POWER RESOURCES ... REMENT OF FORESTS & WATERS ON THIS ... DAY OF ... A.D. 19...

REC'D ... FOR ...
SEE R...





GENERAL NOTES:

1. SECTIONS ARE INDICATED THUS (2/2) THE UPPER NUMBER INDICATES THE SHEET ON WHICH THE SECTION IS CUT OR SHOWN, AND THE LOWER NUMBER INDICATES THE SECTION NUMBER.
2. PAYMENT ITEM NUMBERS ARE INDICATED THUS (6).
3. FOR SITE TOPOGRAPHY AND PROJECT LAYOUT SEE SHEET 3.
4. ALL AREAS AFFECTED BY CONSTRUCTION WILL BE TOPSOILED AND SEEDED AS DESIGNATED BY THE ENGINEER AND THE BUREAU.

PLATE #2

ALL DIMENSIONS AND EXISTING CONDITIONS SHALL BE CHECKED AND VERIFIED BY THE CONTRACTOR AT THE SITE

REVISED					
SYMBOL	CORRECTIONS				

APPROVALS

APPROVED
DIRECTOR OF ENGINEERING AND CONSTRUCTION
APPROVED, RECOMMENDED
SUPERVISING ENGINEER/ENGINEER BUREAU OF CONSTRUCTION
APPROVED FOR DEPT.
SUBMITTED BY ... DATE ...
ACCEPTED BY ... CO-ORDINATOR
BY ...
BUREAU OF ENGINEERING AND CONSTRUCTION CHECKED BY

ARCH	STRUC	MECH	ELEC

PROJECT NO. G.C. 5493-0

LOCATION AND RESERVOIR MAPS, GENERAL PLAN AND PROFILE

CONSTRUCTION OF SHOHOLA DAM STATE GAME LANDS NO 180

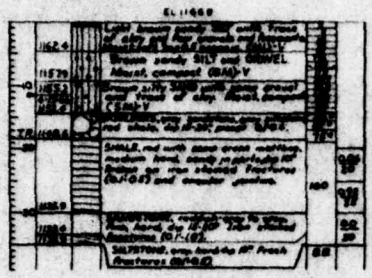
SHOHOLA FALLS, PIKE COUNTY, PENNSYLVANIA

GARNETT FLEMING CONDON & CARPENTER, INC
ENGINEERS
600 N. DECORE ST. HARRISBURG, PENNA.

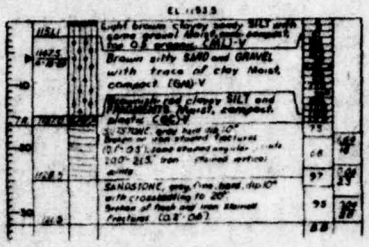
DATE	COMMONWEALTH OF PENNSYLVANIA	SHEET NO.
SCALE AS SHOWN	RAYMOND P. SHAFER, GOVERNOR DEPT. OF PROPERTY AND SUPPLIES PERRY C. HAMILTON, SECRETARY HARRISBURG, PENNSYLVANIA	2

2

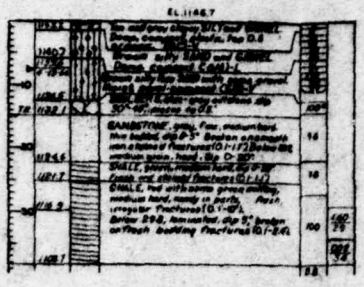
DH-1

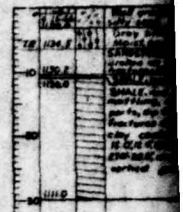


DH-2



DH-3





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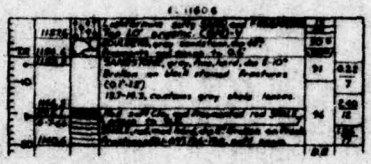
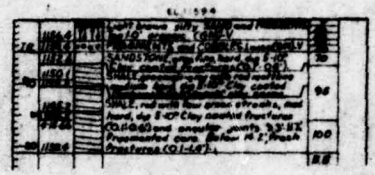
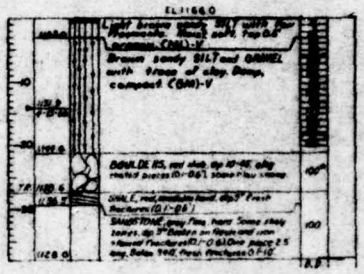
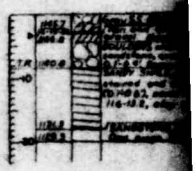


DH-7



DH-8





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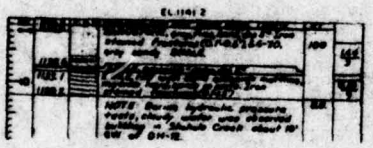
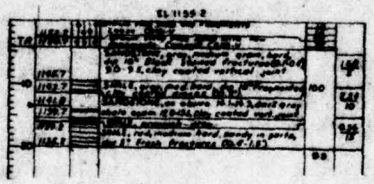


DH-13



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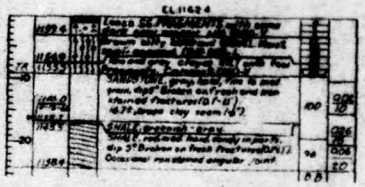
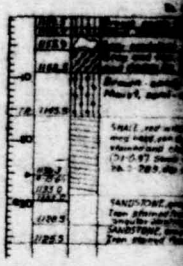
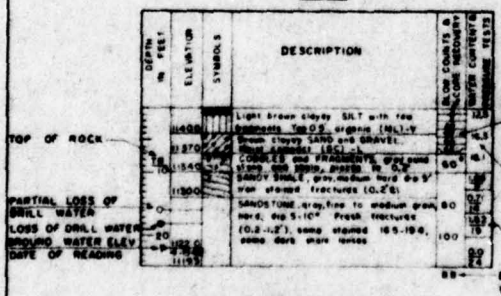




LEGEND



BLOWS PER FOOT OF 300 HAMMER FALLING 18" ON SAMPLING SPOON

WATER CONTENT IN OVERBURDEN

AVERAGE WATER LOSS IN CU FT PER MIN PRESSURE IN PSI

V- VISUAL CLASSIFICATION

L- LABORATORY CLASSIFICATION

*- DENOTES CORE DRILLING IN OVERBURDEN

Organic material, topsoil, sod, roots

Silty CLAY (CL)

Clayey SILT or clayey SAND and GRAVEL, FRAGMENTS (GC)

Sandy or clayey SILT (ML)

Silty SAND (SM)

SYMBOLS OVERBURDEN

SILTY SAND or sandy SILT and GRAVEL FRAGMENTS (GM) or (GM GW) or (GM-GC)

Poorly graded SAND (SP) or (SP-SM)

SAND and GRAVEL (GP-GM)

GRAVEL or FRAGMENTS with silty SAND (GW) or (GW-GC)

BOULDERS and COBBLES

ROCK

SHALE

SANDSTONE

SILTSTONE or SANDY SHALE

GENERAL NOTES

1 DRILL HOLES (DH) WERE ACCOMPLISHED... A 3" I.D. x 2.0' LONG SPOON (UNLESS ... SAMPLES. THESE SAMPLE SPOONS ... FALLING 18". HOWEVER, IN SOME CAS... FACILITATE ADVANCING THE BORING. ... BIT UNLESS OTHERWISE SPECIFIED.

2 THE BORINGS INCLUDED ON THESE ... IMMEDIATE AREA OF THE WORK. THE ... PRESENTED IN THE FOUNDATION EXPLO...

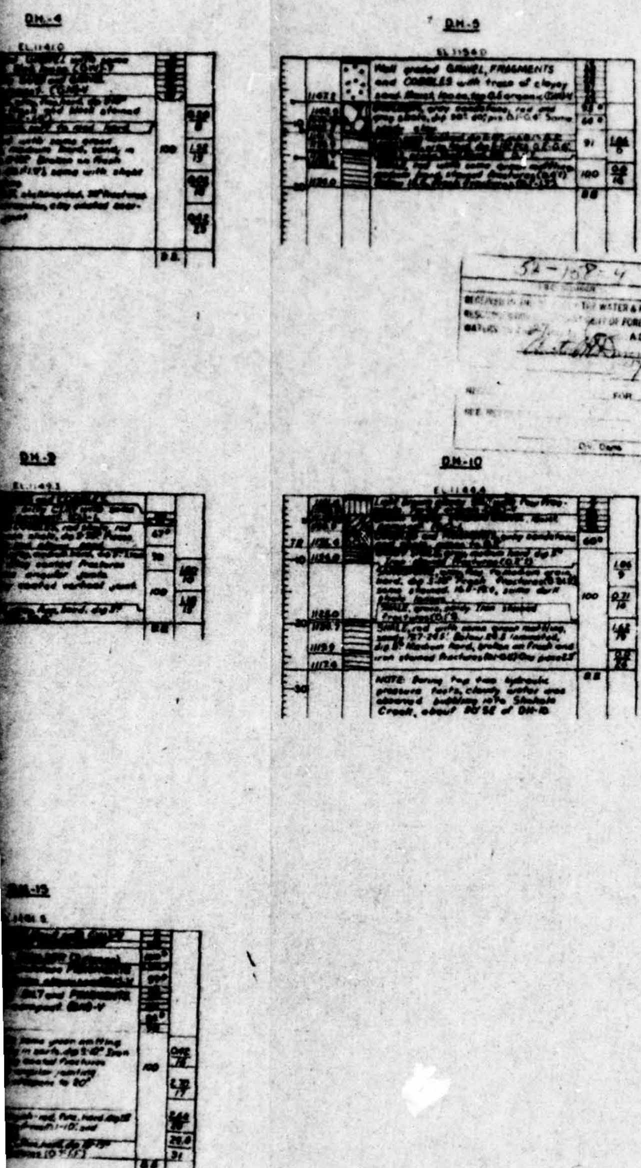
3 LETTER SYMBOLS SUCH AS SC, SC, CL, ... SOIL CLASSIFICATION SYSTEM MIL-STD-...

4 THE GROUND WATER LEVEL SHOWN ON ... WATER HAD STABILIZED IN THE HOLE ... NOT NECESSARILY THE LEVEL AT WH... THE DRILLING OPERATION

5 DESCRIPTION OF SOILS GIVEN ON THE ... JAR SAMPLES. PRESENCE OF BOULDERS ... WAS A REFUSAL IN THE DRIVING OPE... BE NOTED, HOWEVER, THAT IN MANY ... MAY HAVE BEEN PENETRATED BY BO... IN THE LOGS OF THE DRILL HOLES. ... IN THE RIGHT HAND COLUMN OF THE ... DUE TO A COBBLE OR SMALL BOULD...

6 WATER CONTENTS SHOWN IN RIGHT HAN... LOGS ARE THE WATER CONTENTS (%) ... SOIL RECOVERED. ALL WATER CONTENT ... MATERIAL UNLESS OTHERWISE NOTED.

7 TEST PITS (TP) ARE MACHINE DUG.



...D BY DRIVE BORING PROCEDURE USING ...OTHERWISE NOTED) FOR DISTURBED ...WERE ADVANCED BY A 300# HAMMER ...ES THE OVERBURDEN WAS CORED TO ... ROCK WAS CORED WITH A 2 1/8" (NX)

...ORINGS ARE THOSE IN OR NEAR THE ... LOCATION OF THESE BORINGS IS ...RATION SITE AND LOCATION MAPS.

...ARE IN ACCORDANCE WITH THE UNIFIED ...SIGNAL OF THE CORPS OF ENGINEERS, U.S. ARMY.

... THE LOGS REPRESENTS THE LEVEL AT WHICH ... PRIOR TO REMOVAL OF THE CASING; IT IS ...CH WATER WAS FIRST ENCOUNTERED IN

...LOGS IS BASED ON EXAMINATION OF QUART SIZE ... HAS BEEN NOTED ON THE LOGS WHEN THERE ...RATION WITH SUBSEQUENT CORING. IT SHOULD ...STANCES COBBLES, OR EVEN SMALL BOULDERS ...VING AND MAY NOT THEREFORE BE REFLECTED ... HIGH RESISTANCE TO DRIVING AS RECORDED ... LOGS IS CONSIDERED IN MANY CASES TO BE ...

...C COLUMN OF DRILL HOLE AND TEST PIT ... DRY WEIGHT) OF THE TOTAL SAMPLE OF ...S ARE DETERMINED ON MINUS 3/4

ALL DIMENSIONS AND EXISTING ... CHECKED AND VERIFIED BY THE ... SITE

PLATE #3

REVISED					
	CORRECTIONS				

APPROVALS

APPROVED
DIRECTOR OF ENGINEERING AND CONSTRUCTION
APPROVAL RECOMMENDED
SUPERVISING ARCHITECT/ENGINEER BUREAU OF CONSTRUCTION
APPROVED FOR DEPT.
SUBMITTED BY
ARCH.-ENG.
ACCEPTED BY
CONTRACTOR
BY

BUREAU OF ENGINEERING AND CONSTRUCTION
CHECKED BY

ARCH	STRUC	MECH	ELEC

PROJECT NO. G.C. 5493-0

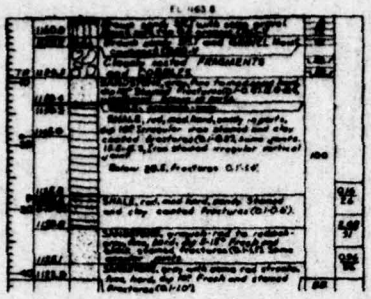
DAM SITE FOUNDATION EXPLORATION-LOGS OF CORE BORINGS

CONSTRUCTION OF SHOHOLA DAM
STATE GAME LANDS NO. 180
SHOHOLA FALLS, PIKE COUNTY, PENNSYLVANIA

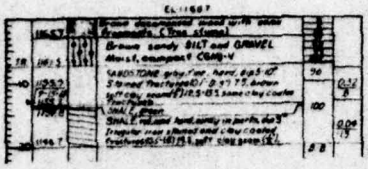
DATE	COMMONWEALTH OF PENNSYLVANIA	SHEET NO
SCALE AS SHOWN	RAYMOND P. SHAFER GOVERNOR DEPT. OF PROPERTY AND SUPPLIES HARRISBURG, PENNSYLVANIA	4

2

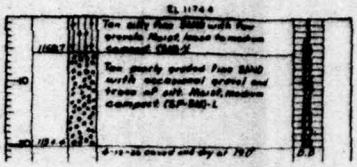
DH-18



DH-19



DH-20



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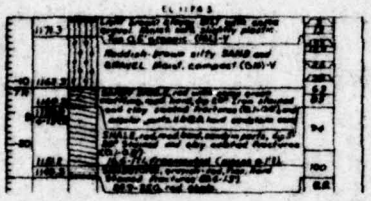
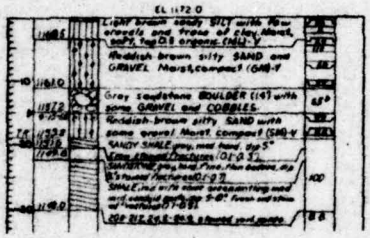
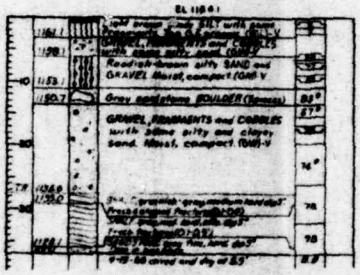


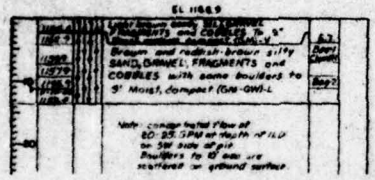
DH-26



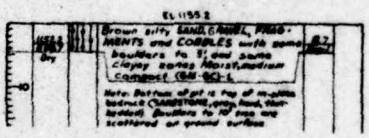
DH-27



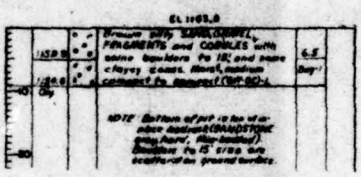
TP-1



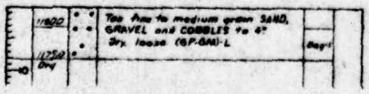
TP-2



TP-3



TP-6



GENERAL NOTES

52 - 158 = 5
FILE NUMBER

RECEIVED IN THE OFFICE OF THE WATER & POWER RESOURCES BOARD, DEPARTMENT OF FORESTS & WATERS ON THE 27 DAY OF ___ A.D. 19 67

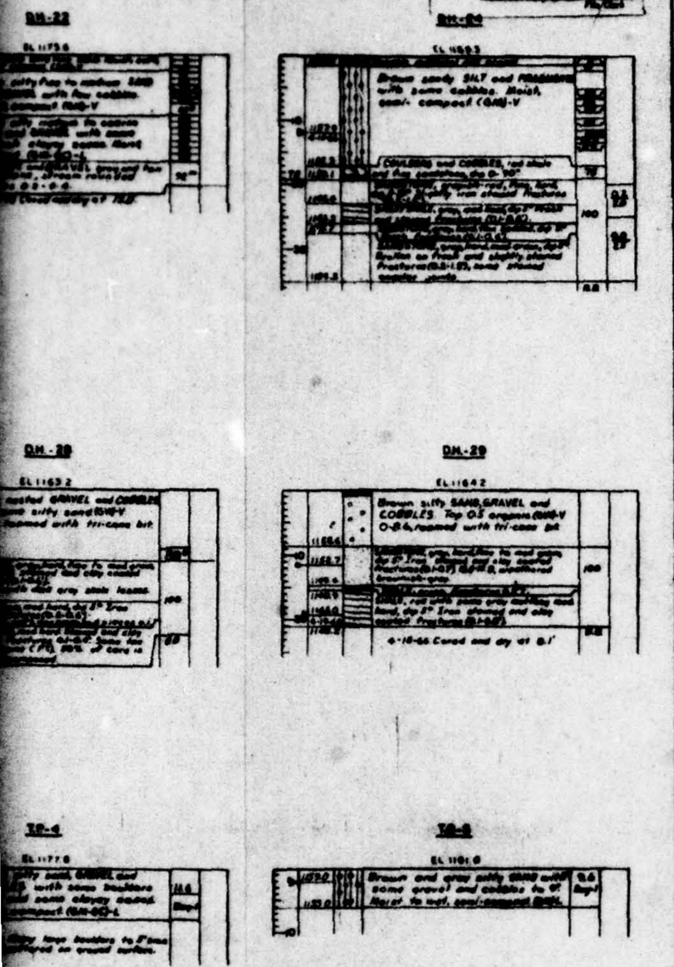


PLATE #4

REVISED					
SYMBOL	CORRECTIONS				

APPROVALS

DIRECTOR OF ENGINEERING AND CONSTRUCTION

SUPERVISING ARCHITECT-ENGINEER, BUREAU OF CONSTRUCTION

SUBMITTED BY — ARCH.-ENG.

ACCEPTED BY — CONTRACTOR

BY

BUREAU OF ENGINEERING AND CONSTRUCTION
CHECKED BY:

ARCH	STRUC	MECH	ELEC.

PROJECT NO. G.C. 5493-0

DAM SITE FOUNDATION EXPLORATION-
LOGS OF CORE BORINGS AND TEST PITS

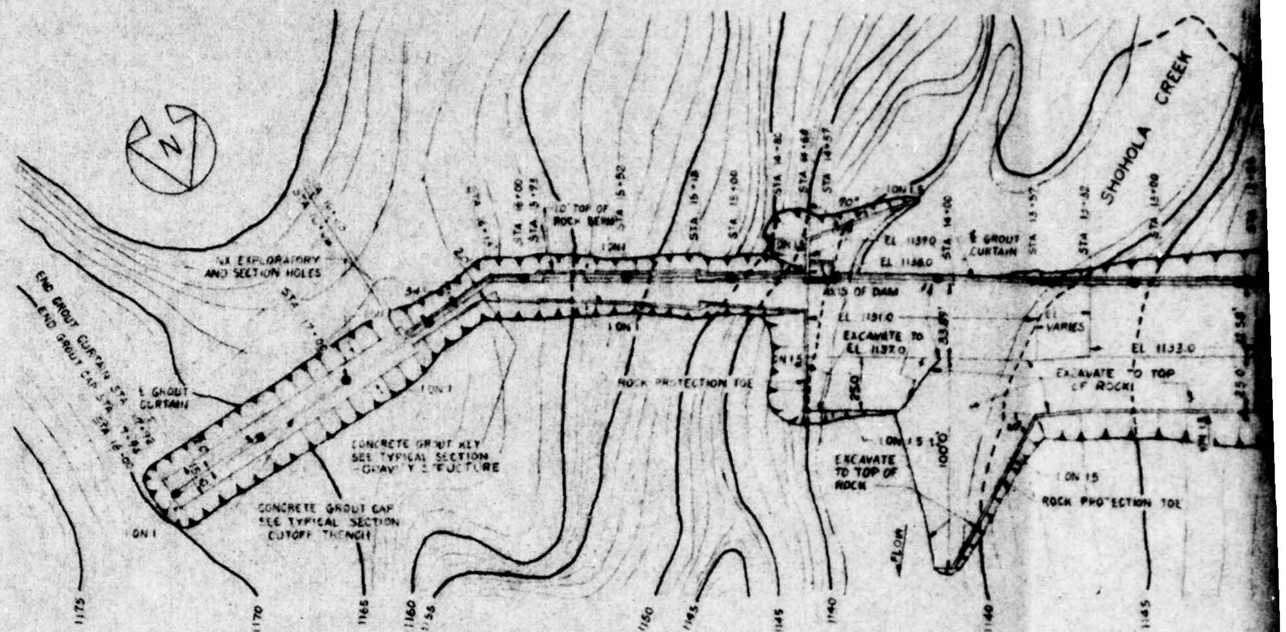
CONSTRUCTION OF SHOHOLA DAM
STATE GAME LANDS NO. 180
SHOHOLA FALLS, PIKE COUNTY, PENNSYLVANIA

ENGINEERS
HARRISBURG, PENNA.

DATE	COMMONWEALTH OF PENNSYLVANIA — GOVERNOR — DEPT. OF PROPERTY AND SUPPLIES — SECRETARY — HARRISBURG, PENNSYLVANIA	SHEET NO.
SCALE AS SHOWN		5

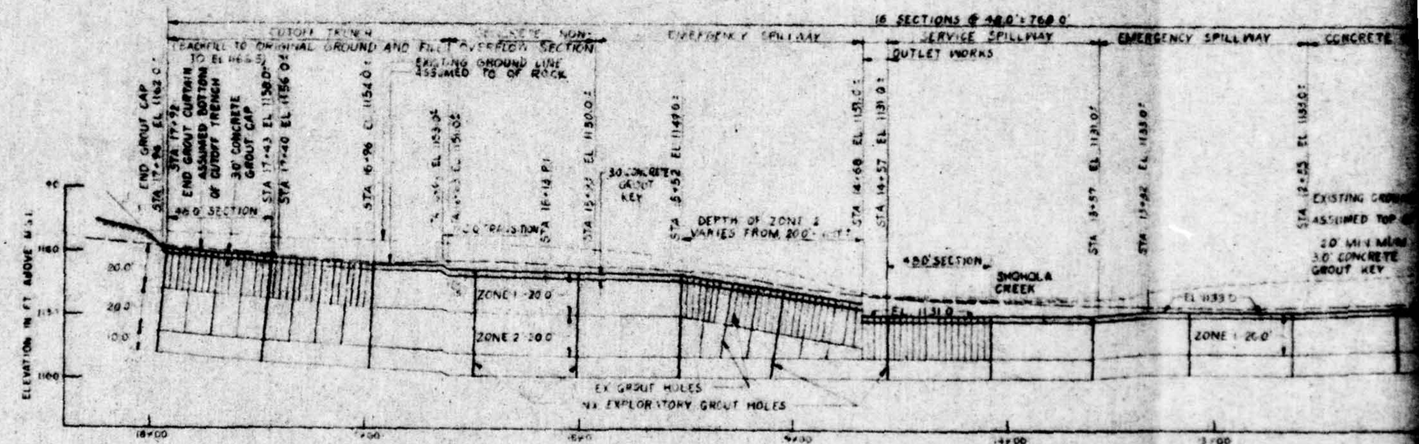
ALL DIMENSIONS AND EXISTING ... SHALL BE CHECKED AND VERIFIED BY ... AT THE SITE.

2



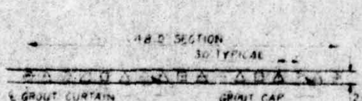
PLAN

SCALE 1" = 30'

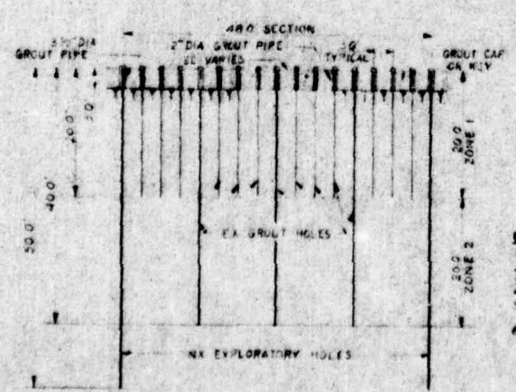


PROFILE ALONG ℄ GROUT CURTAIN

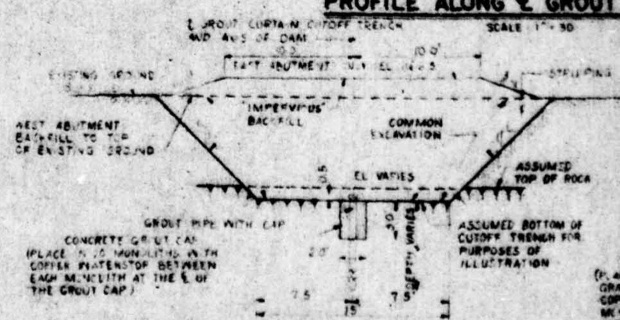
SCALE 1" = 30'



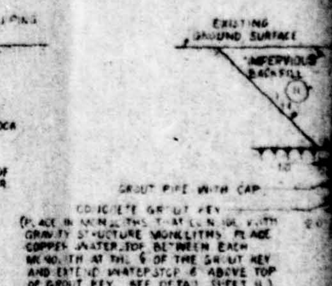
PLAN



SECTION ALONG ℄ GROUT CURTAIN



TYPICAL SECTION CUTOFF TRENCH



TYPICAL SECTION

NOTE

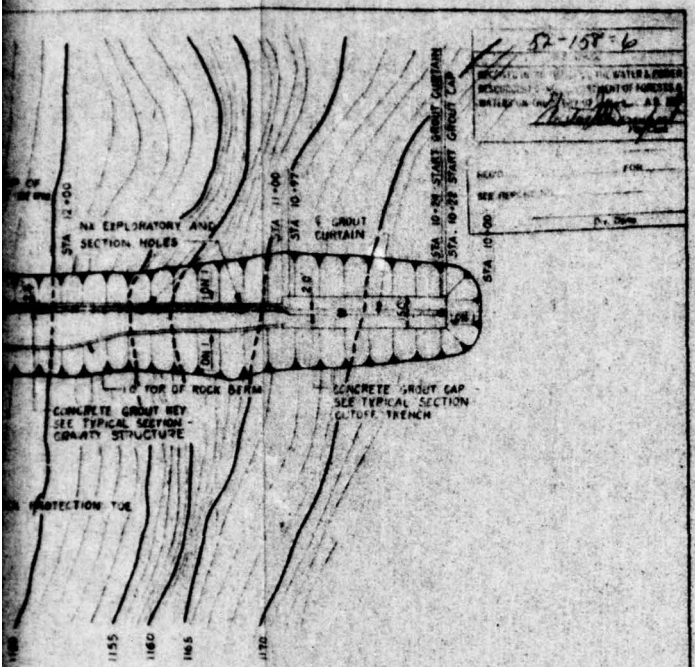
1. USE [illegible] DIA BLACK STEEL PIPE FOR [illegible] NX GROUT HOLES
2. USE 2" DIA BLACK STEEL PIPE FOR [illegible] EX GROUT HOLES
3. IF EXPANSION PLUG IS USED THE TOP IS SHALL BE DRILLED TO 3" DIA
4. CEMENT PIPE INTO HOLE AFTER DRILLING IS COMPLETE
5. GROUT PIPES THROUGH CONCRETE GROUT CAP AND KEY SHALL BE ACCURATELY PLACED AND FIRMLY SUPPORTED PRIOR TO PLACING CONCRETE
6. GROUT PIPES STICKING ABOVE THE GROUT KEY AND WITHIN THE CONCRETE MONOLITHS SHALL BE LEFT IN PLACE. ALL OTHER GROUT PIPES SHALL BE CUT FLUSH AFTER GROUTING IS COMPLETE

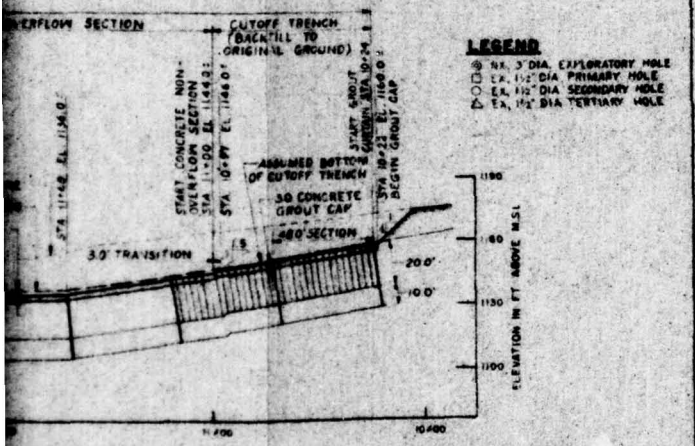
GENERAL NOTES

[illegible]

GROUTING DETAILS

NOT TO SCALE

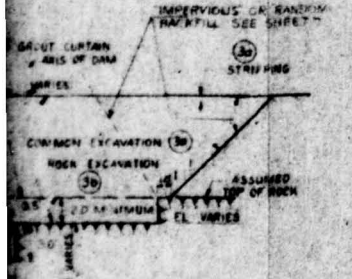




LEGEND

- NX, 3" DIA. EXPLORATORY HOLE
- EA, 1½" DIA PRIMARY HOLE
- EA, 1½" DIA SECONDARY HOLE
- EA, 1½" DIA TERTIARY HOLE

PLATE #5



GRAVITY STRUCTURE

EXPLORATORY HOLES WILL BE PAID FOR UNDER ITEM
GROUT HOLES WILL BE PAID FOR UNDER ITEM
BE PAID FOR UNDER ITEM
GROUT PIPE WILL BE PAID FOR UNDER ITEM
CONCRETE WILL BE PAID FOR UNDER ITEM
WILL BE PAID FOR UNDER ITEM
NOTES SEE SHEET 2

ALL DIMENSIONS AND EXISTING CONDITIONS SHALL BE CHECKED AND VERIFIED BY THE CONTRACTOR ON SITE

REVISED			
NUMBER	CORRECTIONS		

APPROVALS

BUREAU OF ENGINEERING AND CONSTRUCTION

SUBMITTED BY _____ DIST. ENG.

ACCEPTED BY _____ CONTRACTOR

BUREAU OF ENGINEERING AND CONSTRUCTION CHECKED BY

ENGR	STRUC	MECH	ELEC

PROJECT NO. GC 5483-0

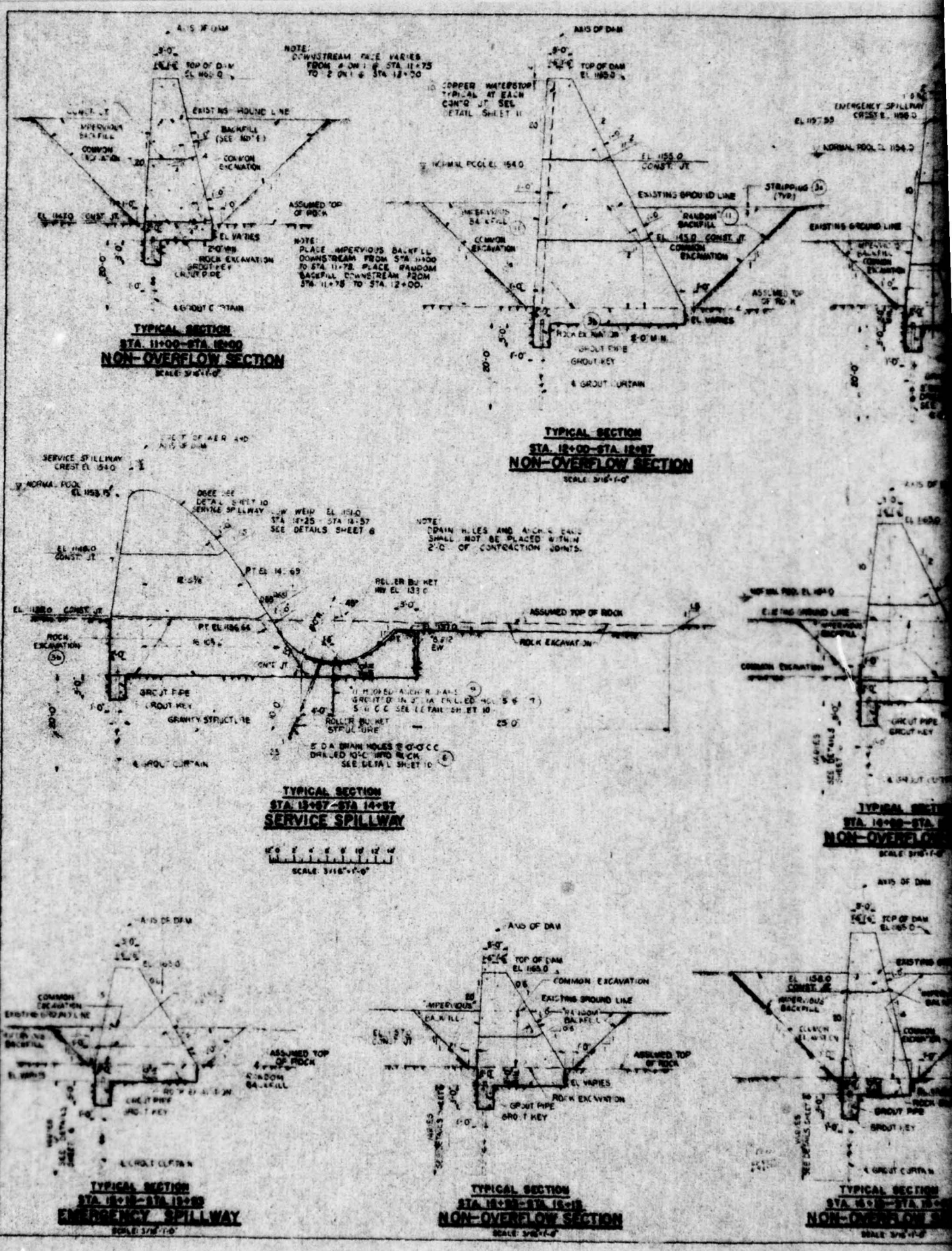
FOUNDATION EXCAVATION-GROUTING DETAILS

CONSTRUCTION OF SHICKSHOCK DAM
STATE GAME LANDS NO. 180
SHICKSHOCK CREEK, PINE CREEK TOWNSHIP

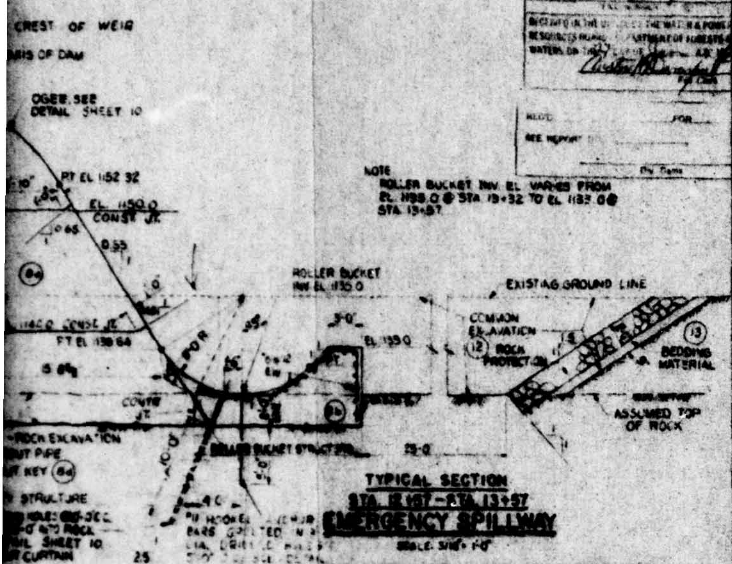
DATE	COMMONWEALTH OF PENNSYLVANIA	SHEET NO.
SCALE AS SHOWN	DEPT. OF PROPERTY AND SUPPLIES	6

RAYMOND P. SHAFER, GOVERNOR
PEGGY C. HAMILTON, SECRETARY

2


TYPICAL SECTION
STA. 11+00-STA. 18+00
NON-OVERFLOW SECTION
TYPICAL SECTION
STA. 18+00-STA. 12+97
NON-OVERFLOW SECTION
TYPICAL SECTION
STA. 12+97-STA 14+57
SERVICE SPILLWAY
TYPICAL SECTION
EMERGENCY SPILLWAY
TYPICAL SECTION
NON-OVERFLOW SECTION

62-159-7



TYPICAL SECTION
STA. 12+57 - STA. 13+57
EMERGENCY SPILLWAY
SCALE: 3/16" = 1'-0"

REINFORCING STEEL LAP SPLICES AND EMBEDMENTS

BAR SIZE	MINIMUM LAP SPLICE LENGTH (INCHES) — TENSION — TOP BARS	TENSION — OTHER BARS	COMPRESSION — ALL BARS	MIN EMBEDMENT LENGTH (INCHES) — TENSION — TOP BARS	TENSION — OTHER BARS	COMPRESSION — ALL BARS
4	[illegible]	[illegible]	[illegible]	7	6	6
5	[illegible]	[illegible]	13	11	7	7
6	24	22	[illegible]	15	11	8
7	[illegible]	25	16	21	15	[illegible]
8	43	30	20	27	19	11
9	55	39	23	34	24	13
10	69	49	25	43	31	14
11	85	60	28	53	38	16

NOTE:
TABLE BASED ON ACI-318-63 (WORKING STRESS DESIGN) WITH f'_c = 3,000 PSI, f_s = 20,000 PSI AND f_y = 40,000 PSI.

GENERAL CONCRETE AND REINFORCING STEEL NOTES

1. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 3/4" UNLESS OTHERWISE NOTED OR DIRECTED.
2. ALL REINFORCING STEEL SPLICE LAPS AND EMBEDMENTS SHALL BE IN ACCORDANCE WITH THE ACI STANDARD BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE (ACI 318-63). SEE TABLE THIS SHEET.
3. ALL BAR BENDING DETAILS SHALL BE IN ACCORDANCE WITH ACI STANDARDS UNLESS OTHERWISE SHOWN.
4. REINFORCING STEEL SHALL NOT BE PLACED WITHIN 3" OF CONTRACTION JOINTS.
5. ALL GRAVITY DAM CONCRETE WILL BE PAID FOR UNDER ITEM 8a.
6. ALL ROLLER BUCKET CONCRETE WILL BE PAID FOR UNDER ITEM 8b.
7. ALL WALLS, PIERS AND SLABS WILL BE PAID FOR UNDER ITEM 8c.
8. ALL GROUT CAP AND KEY CONCRETE WILL BE PAID FOR UNDER ITEM 8d.
9. ALL REINFORCING STEEL WILL BE PAID FOR UNDER ITEM 9.

GENERAL NOTES:
1. FOR OTHER GENERAL NOTES SEE SHEET 2.

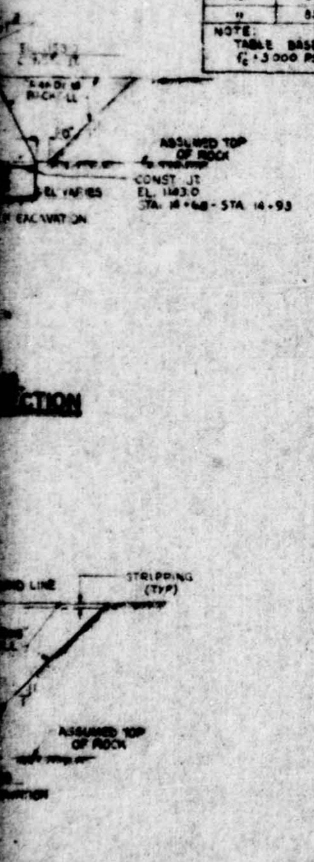


PLATE #6

REVISED

APPROVALS

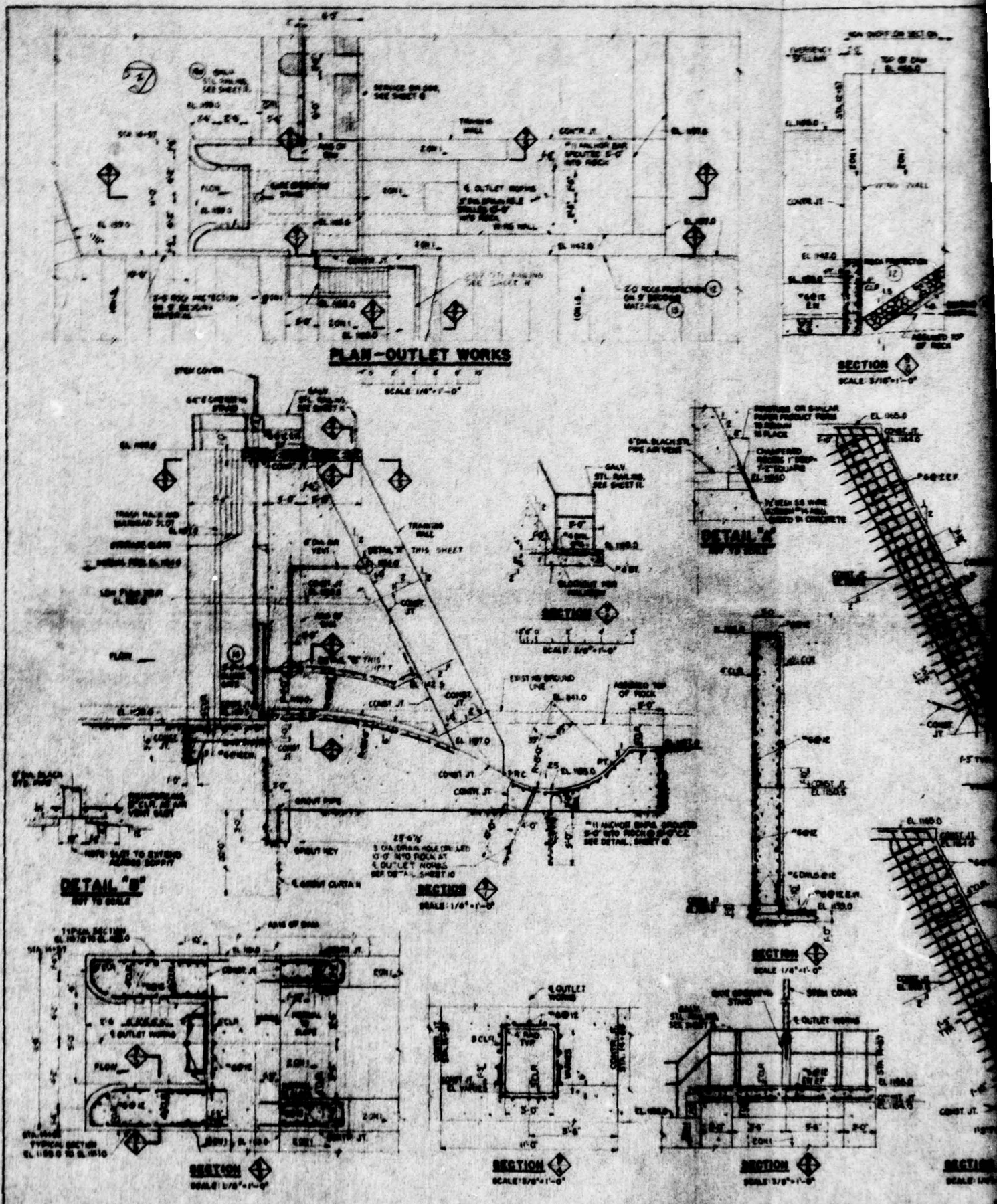
BUREAU OF ENGINEERING AND CONSTRUCTION CHECKED BY

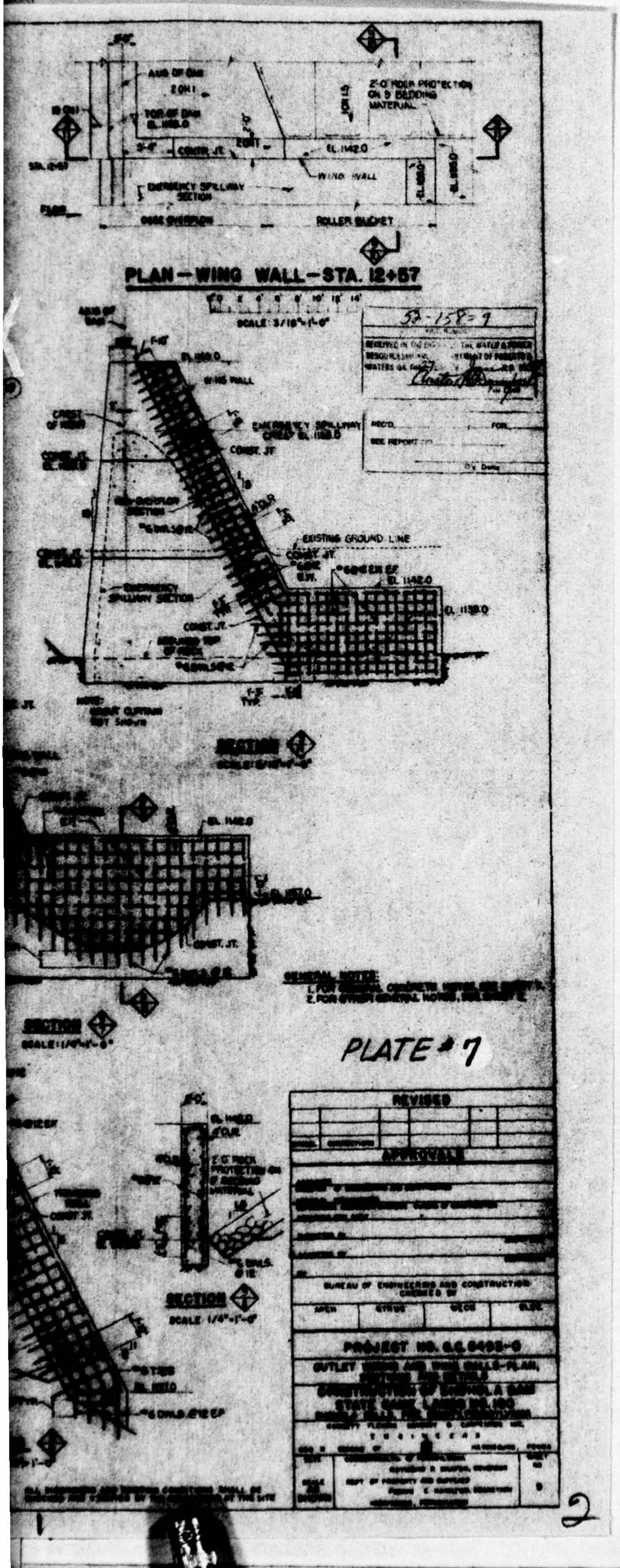
PROJECT NO. [illegible]

SERVICE AND EMERGENCY SPILLWAYS, NON-OVERFLOW SECTIONS

ALL DIMENSIONS AND EXISTING CONDITIONS [illegible] CHECKED AND VERIFIED BY THE [illegible]

2


PLAN-OUTLET WORKS
SECTION
DETAIL "A"
DETAIL "B"
SECTION
SECTION
SECTION
SECTION
SECTION


PLAN - WING WALL - STA. 12+57
SCALE: 3/16"=1'-0"
2'-0" ROCK PROTECTION ON 9" BEDDING MATERIAL
EL. 1142.0
WING WALL
EMERGENCY SPILLWAY SECTION
ROLLER BUCKET
52-158-9
EXISTING GROUND LINE
CONST. JT.
EL. 1138.0
EMERGENCY SPILLWAY SECTION
SECTION
GENERAL NOTES:
PLATE #7
REVISED
APPROVALS
BUREAU OF ENGINEERING AND CONSTRUCTION
SECTION
SCALE 1/4"=1'-0"
2

APPENDIX

F

Site Geology

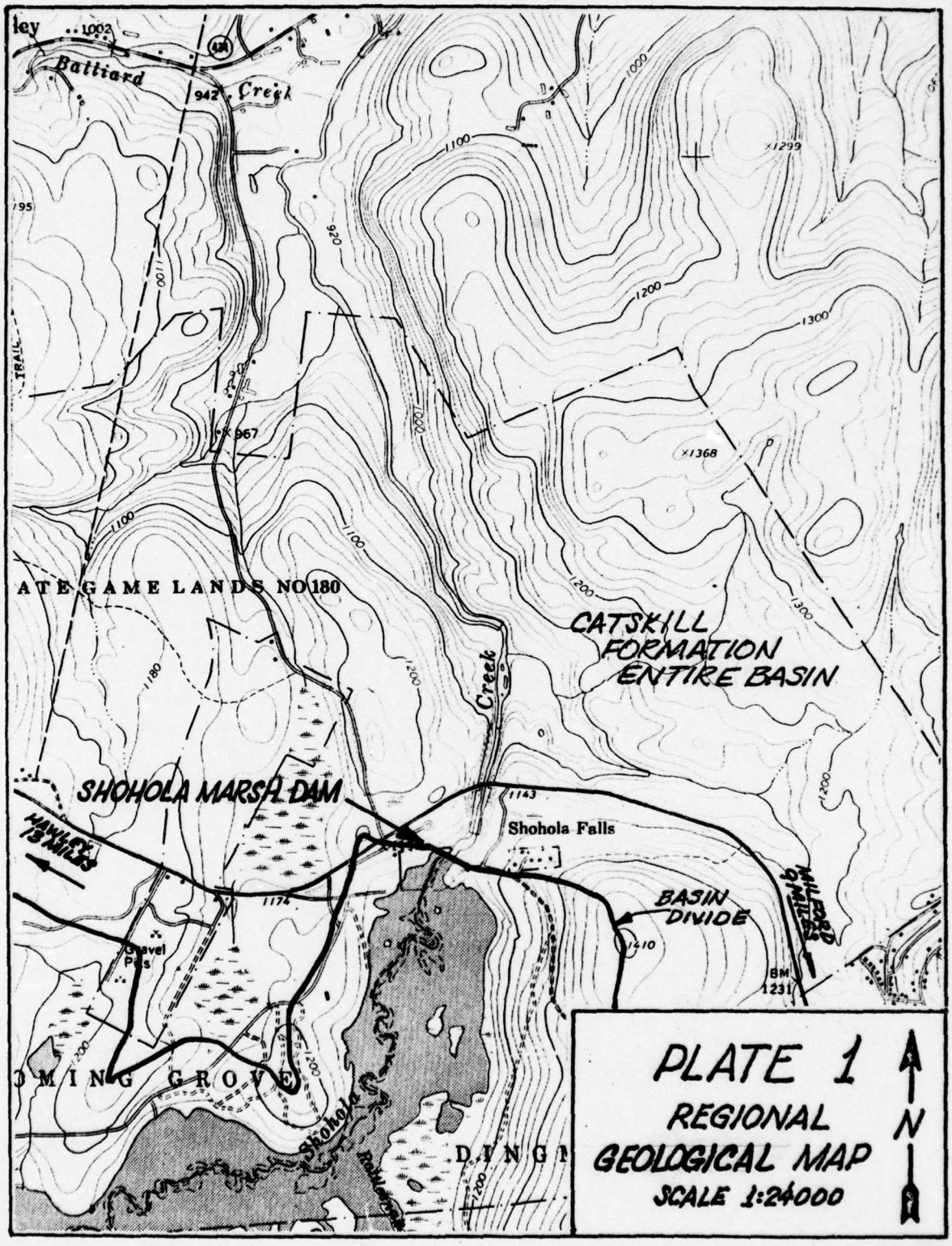
SITE GEOLOGY

Shohola Marsh Reservoir

Shohola Dam and Reservoir is located in the Eastern Glaciated section of the Appalachian Plateau physiographic province. The site is underlain by varying thicknesses of Pleistocone glacial debris and till which mantle the Devonian age shales and sandstones. The bedrock units, which form part of the Catskill formation, dip gently to the north at about 5^{o} to 8^{o}. In local zones crossbedded sandstones dip to nearly 20^{o}. These units may represent the southeast limb of the minor fold known as the Shohola syncline.

Bedrock units forming the foundation of the concrete gravity dam are fractured and jointed as described in the logs of exploratory holes made during the design stage. These weaknesses in the foundation were treated by pressure grouting which apparently was successful in reducing seepage beneath the structure.

No faulting or other major structural defects are known to exist in this area of the Appalachian Plateau.


Battiard
Creek
ATE GAME LANDS NO 180
SHOHOLA MARSH DAM
CATSKILL
FORMATION
ENTIRE BASIN
Shohola Falls
BASIN
DIVIDE
Gravel
Pits
TRAIL
Creek
PLATE 1
REGIONAL
GEOLOGICAL MAP
SCALE 1:24000
N

APPENDIX

G

Structural Stability Data

O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
Shohola Marsh Dam				

Table of Contents APPENDIX G

O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
Shohola Fall Dam	1	[illegible]	3/13/79	

Generalized Loading Diagram for Structural Stability Analyses of the Dam

Sh 2

****

STA. 12+00 TO 12+57 NON-OVERFLOW SECTION SHOHOLA MARSH DAM

NORMAL POOL

****

BASE ELEVATION= 1135.00FT. TOP ELEVATION= 1165.00FT. BASE WIDTH= 18.50FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 1154.00FT. TAILWATER ELEVATION= 1139.50FT. EARTHQUAKE ACCELERATION###.0000 (HORIZ),.0000 (VERT)
SILT ELEVATION= 1150.00FT. SILT DENSITY(SUBMERGED)= 68.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 18.50FT. FRICTION FACTOR= .70

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION	PERCENT OF HEADWATER
.00	24.00
18.50	67.00

****

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	49.01	11.36	556.96	
HEADWATER	11.26	6.33		71.26
TAILWATER	.63	1.50	.95	
UPLIFT	9.98	10.71		106.85
SILT	2.55	5.00		12.74
D/S SOIL (VERT)	7.00	2.50	17.50	
D/S SOIL (HORIZ)	7.00	5.00	35.00	
			*********	*********
			610.40	190.85

****

NET HORIZONTAL FORCE= 6.18 KIPS
NET VERTICAL FORCE= 46.03 KIPS
NET MOMENT= 419.55KIP-FEET
X-BAR OF FOUNDATION REACTION= 9.11 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= .14 FEET
FOUNDATION REACTION PRESSURES#######TOE= 18.04 PSI#######HEEL= 16.52 PSI#######
OVERTURNING FACTOR OF SAFETY= 3.20
SLIDING FACTOR OF SAFETY= 5.21
DEVELOPED FRICTION FACTOR-(NO SHEAR)= .13
SLIDING WITH SHEAR FACTOR OF SAFETY= 26.77(SHEAR ACROSS FULL BASE WIDTH)

Sh 3

****

STA. 12+00 TO 12+57 NON-OVERFLOW SECTION SHOHOLA MARSH DAM

NORMAL POOL AND ICE LOAD

****

BASE ELEVATION= 1135.00FT. TOP ELEVATION= 1165.00FT. BASE WIDTH= 18.50FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 1154.00FT. TAILWATER ELEVATION= 1139.50FT. EARTHQUAKE ACCELERATION=##.000G (HORIZ),.000G (VERT)
SILT ELEVATION= 1150.00FT. SILT DENSITY(SUBMERGED)= 68.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 18.50FT. FRICTION FACTOR= .70

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION	PERCENT OF HEADWATER
.00	24.00
18.50	67.00

****

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	49.01	11.36	556.96	
HEADWATER	11.26	6.33		71.26
TAILWATER	.63	1.50	.95	
UPLIFT	9.98	10.71		106.85
SILT	2.55	5.00		12.74
D/S SOIL (VERT)	7.00	2.50	17.50	
D/S SOIL (HORIZ)	7.00	5.00	35.00	
ICE LOAD	5.00	27.50		137.50
			**********	**********
			610.40	328.35

****

NET HORIZONTAL FORCE= 11.18 KIPS
NET VERTICAL FORCE= 46.03 KIPS
NET MOMENT= 282.05KIP-FEET
X-BAR OF FOUNDATION REACTION= 6.13 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 3.12 FEET
**********FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE*****TENSION AT HEEL OF DAM*****
FOUNDATION REACTION PRESSURES********TOE= 34.78 PSI********HEEL= -.22 PSI********
OVERTURNING FACTOR OF SAFETY= 1.86
SLIDING FACTOR OF SAFETY= 2.88
DEVELOPED FRICTION FACTOR (NO SHEAR)= .24
SLIDING WITH SHEAR FACTOR OF SAFETY= 14.80(SHEAR ACROSS FULL BASE WIDTH)

SH 4

****

STA. 12+00 TO 12+57 NON-OVERFLOW SECTION SHOHOLA MARSH DAM

TOP OF DAM

****

BASE ELEVATION= 1135.00FT. TOP ELEVATION= 1165.00FT. BASE WIDTH= 18.50FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 1165.00FT. TAILWATER ELEVATION= 1149.00FT. EARTHQUAKE ACCELERATION=.000G (HORIZ)+.000G (VERT)
SILT ELEVATION= 1150.00FT. SILT DENSITY(SUBMERGED)= 68.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 18.50FT. FRICTION FACTOR= .70

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION	PERCENT OF HEADWATER
.00	47.00
18.50	67.00

****

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	49.01	11.36	556.96	
HEADWATER	28.08	9.99		280.52
TAILWATER	6.12	4.66	28.51	
UPLIFT	19.74	9.79		193.28
SILT	2.55	5.00		12.74
D/S SOIL (VERT)	7.00	2.50	17.50	
D/S SOIL (HORIZ)	7.00	5.00	35.00	
			*********	*********
			637.97	486.53

****

NET HORIZONTAL FORCE= 17.51 KIPS
NET VERTICAL FORCE= 36.27 KIPS
NET MOMENT= 151.43KIP-FEET
X-BAR OF FOUNDATION REACTION= 4.18 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 5.07 FEET
**********FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE*****TENSION AT HEEL OF DAM*****
FOUNDATION REACTION PRESSURES********TOE= 36.02 PSI********HEEL= -8.79 PSI********
OVERTURNING FACTOR OF SAFETY= 1.31
SLIDING FACTOR OF SAFETY= 1.45
DEVELOPED FRICTION FACTOR (NO SHEAR)= .48
SLIDING WITH SHEAR FACTOR OF SAFETY= 9.06(SHEAR ACROSS FULL BASE WIDTH)

Sh 5

****

STA. 12+00 TO 12+57 NON-OVERFLOW SECTION SHOHOLA MARSH DAM

PROGRAM: MAXTHUR 71.0006

****

BASE ELEVATION= 1135.00FT. TOP ELEVATION= 1165.00FT. BASE WIDTH= 18.50FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 1168.10FT. TAILWATER ELEVATION= 1152.00FT. EARTHQUAKE ACCELERATION=.000G (HORIZ)..000G (VERT)
SILT ELEVATION= 1150.00FT. SILT DENSITY(SUBMERGED)= 68.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 18.50FT. FRICTION FACTOR= .70

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION	PERCENT OF HEADWATER
.00	51.00
18.50	67.00

****

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	49.01	11.36	556.96	
HEADWATER	33.88	10.86		367.85
TAILWATER	9.02	5.66	51.04	
UPLIFT	22.54	9.67		217.96
SILT	2.55	5.00		12.74
			*********	*********
			608.00	598.55

****

NET HORIZONTAL FORCE= 27.41 KIPS
NET VERTICAL FORCE= 26.47 KIPS
NET MOMENT= 9.45KIP-FEET
X-BAR OF FOUNDATION REACTION= .36 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= -8.89 FEET
**********FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE*****TENSION AT HEEL OF DAM******
FOUNDATION REACTION PRESSURES*******TOE= 38.59 PSI*******HEEL= -18.72 PSI*******
OVERTURNING FACTOR OF SAFETY= 1.02
SLIDING FACTOR OF SAFETY= .68
DEVELOPED FRICTION FACTOR (NO SHEAR)= 1.04
SLIDING WITH SHEAR FACTOR OF SAFETY= 5.53(SHEAR ACROSS FULL BASE WIDTH)
NUMBER OF STATIONS TO DESCRIBE DAM= 4

STATION	ELEVATION
.00	1137.00
14.00	1165.00
17.00	1165.00
18.50	1137.00

#STOP# 0

9h 6

****

STA. 12+00 TO 12+57 NON-OVERFLOW SECTION SHOHOLA MARSH DAM

1/2 PMF

****

BASE ELEVATION= 1135.00FT. TOP ELEVATION= 1165.00FT. BASE WIDTH= 18.50FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 1162.00FT. TAILWATER ELEVATION= 1149.00FT. EARTHQUAKE ACCELERATION***.000G (HORIZ),.000G (VERT)
SILT ELEVATION= 1150.00FT. SILT DENSITY(SUBMERGED)= 68.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 13.50FT. FRICTION FACTOR= .70

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION	PERCENT OF HEADWATER
.00	47.00
18.50	67.00

****

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	49.01	11.36	556.96	
HEADWATER	22.74	8.99		204.50
TAILWATER	6.12	4.66	28.51	
UPLIFT	17.77	9.79		173.95
SILT	2.55	5.00		12.74
D/S SOIL (VERT)	7.00	2.50	17.50	
D/S SOIL (HORIZ)	7.00	5.00	35.00	
			*********	*********
			637.97	391.18

****

NET HORIZONTAL FORCE= 12.18 KIPS
NET VERTICAL FORCE= 38.24 KIPS
NET MOMENT= 246.78KIP-FEET
X-BAR OF FOUNDATION REACTION= 6.45-FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 2.80 FEET
FOUNDATION REACTION PRESSURES*******TOE= 27.33 PSI*********HEEL= 1.33 PSI********
OVERTURNING FACTOR OF SAFETY= 1.63
SLIDING FACTOR OF SAFETY= 2.20
DEVELOPED FRICTION FACTOR (NO SHEAR)= .32
SLIDING WITH SHEAR FACTOR OF SAFETY= 13.14(SHEAR ACROSS FULL BASE WIDTH)
NUMBER OF STATIONS TO DESCRIBE DAM= 4

STATION	ELEVATION
.00	1137.00
14.00	1165.00
17.00	1165.00
18.50	1137.00

$STOP$ 0

Sh 7

****

STA. 12+57 TO 13+57 LOWER EMERGENCY SPILLWAY - SHOHOLA MARSH DAM

NORMAL POOL

****

BASE ELEVATION= 1133.00FT. TOP ELEVATION= 1158.00FT. BASE WIDTH= 23.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 1154.00FT. TAILWATER ELEVATION= 1139.50FT. EARTHQUAKE ACCELERATION***.000G (HORIZ)+.000G (VERT)
SILT ELEVATION= 1145.00FT. SILT DENSITY(SUBMERGED)= 68.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 23.00FT. FRICTION FACTOR= .70

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION	PERCENT OF HEADWATER
.00	31.00
23.00	67.00

****

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	48.83	13.71	669.22	
HEADWATER	13.76	6.99		96.22
TAILWATER	1.32	2.16	2.85	
UPLIFT	14.77	12.91		190.63
SILT	1.63	4.00		6.52
			**********	**********
			672.07	293.37

****

NET HORIZONTAL FORCE= 14.07 KIPS
NET VERTICAL FORCE= 34.06 KIPS
NET MOMENT= 378.70KIP-FEET
X-BAR OF FOUNDATION REACTION= 11.12 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= .38 FEET
FOUNDATION REACTION PRESSURES*******TOE= 11.31 PSI********HEEL= 9.26 PSI********
OVERTURNING FACTOR OF SAFETY= 2.29
SLIDING FACTOR OF SAFETY= 1.69
DEVELOPED FRICTION FACTOR (NO SHEAR)= .41
SLIDING WITH SHEAR FACTOR OF SAFETY= 13.46(SHEAR ACROSS FULL BASE WIDTH)

Sh 8

****

STA. 12+57 TO 13+57 LOWER EMERGENCY SPILLWAY - SHOHOLA MARSH DAM

NORMAL POOL AND ICE LOAD

****

BASE ELEVATION= 1133.00FT. TOP ELEVATION= 1158.00FT. BASE WIDTH= 23.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 1154.00FT. TAILWATER ELEVATION= 1139.50FT. EARTHQUAKE ACCELERATION=**.000G (HORIZ)..000G (VERT)
SILT ELEVATION= 1145.00FT. SILT DENSITY(SUBMERGED)= 68.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 23.00FT. FRICTION FACTOR= .70

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION	PERCENT OF HEADWATER
.00	31.00
23.00	67.00

****

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	48.83	13.71	669.22	
HEADWATER	13.76	6.99		96.22
TAILWATER	1.32	2.16	2.85	
UPLIFT	14.77	12.91		190.63
SILT	1.63	4.00		6.52
ICE LOAD	5.00	20.50		102.50
			*********	*********
			672.07	395.87

****

NET HORIZONTAL FORCE= 19.07 KIPS
NET VERTICAL FORCE= 34.06 KIPS
NET MOMENT= 276.20KIP-FEET
X-BAR OF FOUNDATION REACTION= 8.11 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 3.39 FEET
FOUNDATION REACTION PRESSURES********TOE= 19.38 PSI********HEEL= 1.19 PSI********
OVERTURNING FACTOR OF SAFETY= 1.70
SLIDING FACTOR OF SAFETY= 1.25
DEVELOPED FRICTION FACTOR (NO SHEAR)= .56
SLIDING WITH SHEAR FACTOR OF SAFETY= 9.93(SHEAR ACROSS FULL BASE WIDTH)

Sh 9

****

STA. 12+57 TO 13+57 LOWER EMERGENCY SPILLWAY - SHOHOLA MARSH DAM

TOP OF DAM

****

BASE ELEVATION= 1133.00FT. TOP ELEVATION= 1158.00FT. BASE WIDTH= 23.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 1165.00FT. TAILWATER ELEVATION= 1149.00FT. EARTHQUAKE ACCELERATION=.000G (HORIZ),.000G (VERT)
SILT ELEVATION= 1145.00FT. SILT DENSITY(SUBMERGED)= 68.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 23.00FT. FRICTION FACTOR= .70

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION	PERCENT OF HEADWATER
.00	50.00
23.00	67.00

****

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	48.83	13.71	669.22	
HEADWATER	30.42	9.83		299.00
TAILWATER	7.99	5.33	42.56	
UPLIFT	26.87	12.06		323.93
SILT	1.63	4.00		6.52
			*********	*********
			711.77	629.45

****

NET HORIZONTAL FORCE= 24.06 KIPS
NET VERTICAL FORCE= 21.96 KIPS
NET MOMENT= 82.32KIP-FEET
X-BAR OF FOUNDATION REACTION= 3.75 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 7.75 FEET
**********FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE******TENSION AT HEEL OF DAM******
FOUNDATION REACTION PRESSURES*******TOE= 20.04 PSI*******HEEL= -6.78 PSI********
OVERTURNING FACTOR OF SAFETY= 1.13
SLIDING FACTOR OF SAFETY= .64
DEVELOPED FRICTION FACTOR (NO SHEAR)= 1.10
SLIDING WITH SHEAR FACTOR OF SAFETY= 7.52(SHEAR ACROSS FULL BASE WIDTH)

Sh 10

****

STA. 12+57 TO 13+57 LOWER EMERGENCY SPILLWAY - SHOHOLA MARSH DAM

PROBABLE MAXIMUM FLOOD

****

BASE ELEVATION= 1133.00FT. TOP ELEVATION= 1158.00FT. BASE WIDTH= 23.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 1168.10FT. TAILWATER ELEVATION= 1152.00FT. EARTHQUAKE ACCELERATION=.000G (HORIZ),.000G (VERT)
SILT ELEVATION= 1145.00FT. SILT DENSITY(SUBMERGED)= 68.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 23.00FT. FRICTION FACTOR= .70

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION	PERCENT OF HEADWATER
.00	54.00
23.00	67.00

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	48.83	13.71	669.22	
HEADWATER	35.26	10.20		359.45
TAILWATER	11.26	6.33	71.26	
UPLIFT	30.48	11.91		363.04
SILT	1.63	4.00		6.52
			*********	*********
			740.48	729.01

NET HORIZONTAL FORCE= 25.62 KIPS
NET VERTICAL FORCE= 18.35 KIPS
NET MOMENT= 11.46KIP-FEET
X-BAR OF FOUNDATION REACTION= .62 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 10.88 FEET
**********FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE*****TENSION AT HEEL OF DAM******
FOUNDATION REACTION PRESSURES*******TOE= 21.26 PSI********HEEL= -10.18 PSI********
OVERTURNING FACTOR OF SAFETY= 1.02
SLIDING FACTOR OF SAFETY= .50
DEVELOPED FRICTION FACTOR (NO-SHEAR)= 1.40
SLIDING WITH SHEAR FACTOR OF SAFETY= 6.96(SHEAR ACROSS FULL BASE WIDTH)
STATIONS OF OGEE PORTION OF SECTION ARE 12.75 AND 19.50
EQUATION OF OGEE CURVATURE IS Y= .16239*X**1.85
NUMBER OF STATIONS TO DESCRIBE DAM= 5

STATION	ELEVATION
.00	1133.00
12.75	1152.32
19.50	1158.00
20.50	1157.56
23.00	1135.00

Sh 11

STA. 12457 TO 13457 LOWER EMERGENCY SPILLWAY - SHOHOLA MARSH DAM

172 FM

BASE ELEVATION= 1133.00FT. TOP ELEVATION= 1158.00FT. BASE WIDTH= 23.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 1163.65FT. TAILWATER ELEVATION= 1149.00FT. EARTHQUAKE ACCELERATION=.000G (HORIZ).000G (VERT)
SILT ELEVATION= 1145.00FT. SILT DENSITY(SUBMERGED)= 68.00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 23.00FT. FRICTION FACTOR= .70

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION	PERCENT OF HEADWATER
.00	50.00
23.00	67.00

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	48.83	13.71	669.22	
HEADWATER	28.31	9.63		272.67
TAILWATER	7.99	5.33	42.56	
UPLIFT	25.73	12.06		310.27
SILT	1.63	4.00		6.52
			*********	*********
			711.77	589.46

NET HORIZONTAL FORCE= 21.96 KIPS
NET VERTICAL FORCE= 23.09 KIPS
NET MOMENT= 122.31KIP-FEET
X-BAR OF FOUNDATION REACTION= 5.30 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 6.20 FEET
********FOUNDATION REACTION NOT IN CENTRAL [illegible] OF BASE********[illegible] AT HEEL OF DAM******
FOUNDATION REACTION PRESSURE********[illegible]
OVERTURNING FACTOR OF SAFETY= 1.21
SLIDING FACTOR OF SAFETY= .74
DEVELOPED FRICTION FACTOR (NO SHEAR)= .95
SLIDING WITH SHEAR FACTOR OF SAFETY= 0.28(SHEAR ACROSS FULL BASE WIDTH)

Sh 12

STA. 13457 TO 14457 SERVICE SPILLWAY SHOHOLA MARSH DAM
NORMAL POOL

BASE ELEVATION= 1131.00FT. TOP ELEVATION= 1154.00FT. BASE WIDTH= 24.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 1154.00FT. TAILWATER ELEVATION= 1139.50FT. EARTHQUAKE ACCELERATION=.000G (HORIZ),.000G (VERT)
SILT ELEVATION= .00FT. SILT DENSITY(SUBMERGED)= .00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 24.00FT. FRICTION FACTOR= .70

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION	PERCENT OF HEADWATER
.00	37.00
24.00	67.00

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	52.58	13.88	729.90	
HEADWATER	16.50	7.66		126.41
TAILWATER	2.25	2.83	6.38	
UPLIFT	17.91	13.15		235.60
			*********	*********
			736.28	362.01

NET HORIZONTAL FORCE= 14.25 KIPS
NET VERTICAL FORCE= 34.66 KIPS
NET MOMENT= 374.27KIP-FEET
X-BAR OF FOUNDATION REACTION= 10.80 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 1.20 FEET
FOUNDATION REACTION PRESSURES=======TOE= 13.05 PSI=======HEEL= 7.01 PSI========
OVERTURNING FACTOR OF SAFETY= 2.03
SLIDING FACTOR OF SAFETY= 1.70
DEVELOPED FRICTION FACTOR (NO SHEAR)= .41
SLIDING WITH SHEAR FACTOR OF SAFETY= 13.83(SHEAR ACROSS FULL BASE WIDTH)

Sh 13

STA. 13457 TO 14457 SERVICE SPILLWAY SHOHOLA MARSH DAM
NORMAL POOL AND ICE LOAD

BASE ELEVATION= 1131.00FT. TOP ELEVATION= 1154.00FT. BASE WIDTH= 24.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 1154.00FT. TAILWATER ELEVATION= 1139.50FT. EARTHQUAKE ACCELERATION***.000G (HORIZ)..000G (VERT)
SILT ELEVATION= .00FT. SILT DENSITY(SUBMERGED)= .00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 24.00FT. FRICTION FACTOR= .70

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION	PERCENT OF HEADWATER
.00	37.00
24.00	67.00

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	52.58	13.88	729.90	
HEADWATER	16.50	7.66		126.41
TAILWATER	2.25	2.83	6.38	
UPLIFT	17.91	13.15		235.60
ICE LOAD	5.00	22.50		112.50
			*********	*********
			736.28	474.51

NET HORIZONTAL FORCE= 19.25 KIPS
NET VERTICAL FORCE= 34.66 KIPS
NET MOMENT= 261.77KIP-FEET
X-BAR OF FOUNDATION REACTION= 7.55 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 4.45 FEET
**********FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE*****TENSION AT HEEL OF DAM*****
FOUNDATION REACTION PRESSURES*******TOE= 21.19 PSI*******HEEL= -1.13 PSI*******
OVERTURNING FACTOR OF SAFETY= 1.55
SLIDING FACTOR OF SAFETY= 1.26
DEVELOPED FRICTION FACTOR (NO SHEAR)= .56
SLIDING WITH SHEAR FACTOR OF SAFETY= 10.24(SHEAR ACROSS FULL BASE WIDTH)

Sh 14

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STA. 13+57 TO 14+57 SERVICE SPILLWAY SHOHOLA MARSH DAM
TOP OF DAM

****

BASE ELEVATION= 1131.00FT. TOP ELEVATION= 1154.00FT. BASE WIDTH= 24.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 1165.00FT. TAILWATER ELEVATION= 1149.00FT. EARTHQUAKE ACCELERATION=.000G (HORIZ),.000G (VERT)
SILT ELEVATION= .00FT. SILT DENSITY(SUBMERGED)= .00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 24.00FT. FRICTION FACTOR= .70

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION	PERCENT OF HEADWATER
.00	53.00
24.00	67.00

****

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	52.58	13.88	729.90	
HEADWATER	32.29	9.54		308.09
TAILWATER	10.11	5.99	60.59	
UPLIFT	30.55	12.47		380.87
			*********	*********
			790.49	688.96

****

NET HORIZONTAL FORCE= 22.18 KIPS
NET VERTICAL FORCE= 22.03 KIPS
NET MOMENT= 101.53KIP-FEET
X-BAR OF FOUNDATION REACTION= 4.61 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 7.39 FEET
**********FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE*****TENSION AT HEEL OF DAM*****
FOUNDATION REACTION PRESSURES********TOE= 18.15 PSI********HEEL= -5.40 PSI********
OVERTURNING FACTOR OF SAFETY= 1.15
SLIDING FACTOR OF SAFETY= .70
DEVELOPED FRICTION FACTOR (NO SHEAR)= 1.01
SLIDING WITH SHEAR FACTOR OF SAFETY= 8.48(SHEAR ACROSS FULL BASE WIDTH)

SH 15

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STA. 13+57 TO 14+57 SERVICE SPILLWAY SHOHOLA MARSH DAM

PROBABLE MAXIMUM FLOOD

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BASE ELEVATION= 1131.00FT. TOP ELEVATION= 1154.00FT. BASE WIDTH= 24.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 1168.10FT. TAILWATER ELEVATION= 1152.00FT. EARTHQUAKE ACCELERATION***.000G (HORIZ)+.000G (VERT)
SILT ELEVATION= .00FT. SILT DENSITY(SUBMERGED)= .00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 24.00FT. FRICTION FACTOR= .70

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION	PERCENT OF HEADWATER
.00	57.00
24.00	67.00

****

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	52.58	13.88	729.90	
HEADWATER	36.74	9.78		359.26
TAILWATER	13.76	6.99	96.22	
UPLIFT	34.45	12.32		424.49
			*********	*********
			826.12	783.74

****

NET HORIZONTAL FORCE= 22.98 KIPS
NET VERTICAL FORCE= 18.13 KIPS
NET MOMENT= 42.37KIP-FEET
X-BAR OF FOUNDATION REACTION= 2.34 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 9.66 FEET
**********FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE*****TENSION AT HEEL OF DAM******
FOUNDATION REACTION PRESSURES*******TOE= 17.92 PSI*******HEEL= -7.43 PSI*******
OVERTURNING FACTOR OF SAFETY= 1.05
SLIDING FACTOR OF SAFETY= .55
DEVELOPED FRICTION FACTOR (NO SHEAR)= 1.27
SLIDING WITH SHEAR FACTOR OF SAFETY= 8.07(SHEAR ACROSS FULL BASE WIDTH)
STATIONS OF OGEE PORTION OF SECTION ARE 8.00 AND 20.28
EQUATION OF OGEE CURVATURE IS Y= .09864*X**1.85
NUMBER OF STATIONS TO DESCRIBE DAM= 5

STATION	ELEVATION
.00	1131.00
8.00	1143.69
20.28	1154.00
22.13	1153.15
24.30	1138.00

STOP 0

Sh 16

STA. 13+57 ID 1+57 SERVICE SPILLWAY SHERIDAN HARBOR DAM
1/2 PMF

BASE ELEVATION= 1131.00FT. TOP ELEVATION= 1154.00FT. BASE WIDTH= 24.00FT. DENSITY= 145.00PCF
HEADWATER ELEVATION= 1163.65FT. TAILWATER ELEVATION= 1149.00FT. EARTHQUAKE ACCELERATION=.000G (HORIZ),.000G (VERT)
SILT ELEVATION= .00FT. SILT DENSITY(SUBMERGED)= .00PCF SILT PRESSURE COEFFICIENT(K)= .33
SHEAR STRESS= 50.00PSI SHEAR WIDTH= 24.00FT. FRICTION FACTOR= .70

NUMBER OF STATIONS TO DESCRIBE UPLIFT= 2

STATION	PERCENT OF HEADWATER
.00	53.00
24.00	67.00

LOADING	FORCE(KIPS)	ARM(FEET)	STABILIZING MOMENT	OVERTURNING MOMENT
WEIGHT OF DAM	52.58	13.88	729.90	
HEADWATER	30.35	9.42		285.81
TAILWATER	10.11	5.99	60.59	
UPLIFT	29.34	12.47		365.75
	#########		########	########
			790.47	651.55

NET HORIZONTAL FORCE= 20.25 KIPS
NET VERTICAL FORCE= 23.24 KIPS
NET MOMENT= 138.94KIP-FEET
X-BAR OF FOUNDATION REACTION= 5.98 FEET
ECCENTRICITY OF FOUNDATION REACTION FROM CENTER= 6.02 FEET
##########FOUNDATION REACTION NOT IN CENTRAL THIRD OF BASE-#####TENSION AT HEEL OF DAM######
FOUNDATION REACTION PRESSURE=########TOE= 16.85 PSI########HEEL= -3.30 PSI########
OVERTURNING FACTOR OF SAFETY= 1.21
SLIDING FACTOR OF SAFETY= .80
DEVELOPED FRICTION FACTOR (NO SHEAR)= .87
SLIDING WITH SHEAR FACTOR OF SAFETY= 9.34(SHEAR ACROSS FULL BASE WIDTH)
STATIONS OF OGEE PORTION OF SECTION ARE 8.00 AND 20.28
EQUATION OF OGEE CURVATURE IS Y= .098648X**1.85
NUMBER OF STATIONS TO DESCRIBE DAM= 5

STATION	ELEVATION
.00	1131.00
8.00	1143.69
20.28	1154.00
22.13	1153.15
24.30	1138.00

STOP 0